

CPU

COMPUTER POWER USER



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SAPPHIRE NITRO R9 300 SERIES

NITROCHARGED FOR GAMERS
WHO DEMAND THE BEST P. 10





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Featuring the **144Hz refresh rate** of a TN panel, the life-like colors of an IPS panel, **MG279Q** brings the best of both worlds and ties it all together with **AMD FreeSync** technology for the smoothest, tear-free gaming experience in existence. With **MG279Q**, victory is simply a function of your own skill.

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Monthly last-page interview with people who help to shape the PC industry.

CORRECTIONS:

On page 15 of the June issue, we incorrectly listed the GIGABYTE GA-X99-SLI's price. The motherboard's MSRP is \$250.

DID YOU FIND THE HIDDEN
CPU LOGO ON OUR COVER?



Gotcha. Here it is.

Contact Us
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or
120 W. Harvest Drive
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Circulation: (800) 334-7458
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email: feedback@cpumag.com





Fractal Core 500 Is A Compact Case That Doesn't Skimp On Features

The recently announced Core 500 is Fractal Design's latest chassis aimed at users who desire a compact form factor that can hold a lot of hardware. The case measures 203 x 250 x 367 mm (HxWxD) but can still handle graphics cards up to 310mm and CPU coolers up to 170mm. Designed for mini-ITX motherboards, the Core 500 has two expansion slots and room for 3 x 3.5-inch drives and 3 x 2.5-inch drives. There's also a removeable 5.25-inch bay for optical drives or a fan control unit. The case comes with one 140mm exhaust fan in the rear (Fractal's Silent Series R3 that runs at 1,000rpm) and can support radiators up to 280mm for liquid cooling. Magnetic filters cover side and top air intakes and there's another filter for the PSU (it can handle modular ATX PSUs up to 160mm). The case has 2 USB 3.0 ports and it comes in just one color: black. MSRP is not yet available.

DXRacer Lets You Game In Style (And Comfort) With RJO ZERO

Gaming for hours on end is fun, but sitting in an uncomfortable chair is not. DXRacer manufactures a whole range of gaming chairs specifically designed to let you play in comfort. Take the RJO ZERO, for example. Part of the Racing Series, this chair can be adjusted in so many ways (seat height, armrest height, armrest angle, back recline) that you can pick the exact position that feels best to you. From the sturdy aluminum five-star base with gas spring to the bevy of well-designed levers, buttons, and related adjustment mechanisms, this chair is built to last. Plus you'll be gaming in style. The RJO comes in a variety of color combinations (we'll be giving away the black and white model shown below at **QUAKECON** this year) and uses carbon-look vinyl to complement polyurethane highlights. MSRP for the Racing Series RJO ZERO from DXRacer is \$369.



WATCHING THE CHIPS FALL

Here is the pricing information for various AMD and Intel CPUs.

CPU	Released	Original Price	Last Month's Price	Online Retail Price*
AMD FX-9590 Eight-Core	6/11/2013	N/A	\$229.99	\$229.99
AMD FX-9370 Eight-Core	6/11/2013	\$375	\$209.99	\$209.99
AMD FX-8350 Eight-Core	10/23/2012	\$195	\$169.99	\$169.99
AMD FX-8320 Eight-Core	10/23/2012	\$169	\$139.99	\$139.99
AMD FX-6350 Six-Core	4/30/2013	\$132	\$125.99	\$125.99
AMD A10-7850K Quad-Core	1/14/2014	\$173	\$139.99	\$129.99
AMD A10-7800 Quad-Core	7/2/2014	\$153	\$139.99	\$124.99
AMD A10-7700K Quad-Core	1/14/2014	\$152	\$119.99	\$129.99
AMD A10-6800K Quad-Core	6/4/2013	\$142**	\$133.99	\$133.95
AMD A10-5800K Quad-Core	10/2/2012	\$122**	\$89.99	\$89.99
Intel Core i7- 5960X Eight-Core	8/29/2014	\$999**	\$1,049.99	\$1,049.99
Intel Core i7- 4960X Six-Core	9/3/2013	\$990**	\$1,029.99	\$1,029.99
Intel Core i7- 5930K Six-Core	8/29/2014	\$583**	\$579.99	\$579.99
Intel Core i7- 4930K Six-Core	9/3/2013	\$583**	\$574.99	\$614.98
Intel Core i7- 5820K Six-Core	8/29/2014	\$389**	\$389.99	\$389.99
Intel Core i7-4790K Quad-Core	6/25/2014	\$339**	\$339.99	\$339.99
Intel Core i7-4770K Quad-Core	6/2/2013	\$339**	\$339.99	\$396.99
Intel Core i7-4820K Quad-Core	9/3/2013	\$323**	\$322.29	\$322.99
Intel Core i7-4790 Quad-Core	5/11/2014	\$303**	\$304.99	\$309.99
Intel Core i5-4690K Quad-Core	6/3/2014	\$242**	\$239.99	\$239.99

* As of June 2015

** Manufacturer's estimated price per 1,000

AORUS X5: Small Size, Big Power

You usually have to sacrifice some computing power in order to gain some mobility, but not with the new AORUS X5 laptop. The X5 claims two world's firsts: the world's first gaming laptop to feature two GeForce 965M graphics chips in SLI mode; and the world's first laptop to have a built-in hardware streaming engine with a full-year XSplit Gamecaster Premium Membership. The powerful laptop is less than .9 inches thick and weighs about 5 1/2 pounds, but it offers gaming performance better than many desktops. The system picked up multiple awards at the recent COMPUTEX international technology trade event in Taipei. Pricing for the AORUS X5 has not yet been released.



MSI's X99A GODLIKE GAMING Is World's First RGB LED Motherboard

MSI loaded up the tech on its latest motherboard and then gave it a memorable moniker: X99A GODLIKE GAMING. The new mobo, unveiled at COMPUTEX, supports Turbo M.2, USB 3.1, and SATA Express, plus offers MSI's Killer DoubleShot-X3 PRO networking software that makes use of two Killer Ethernet chips and the Killer 1535 Wi-Fi module to provide what MSI claims is 2.867Gbps of bandwidth for gaming. Oh, and you can use an MSI Gaming app (on iOS and Android) to control the "Mystic Light" RGB LED lighting effects on the board. Pricing is N/A at the moment.



ZOTAC Customizes Titan X Card With ArcticStorm Hybrid Cooling

With 3,072 cores, the GeForce GTX Titan X is a mighty GPU. Now ZOTAC has announced a new Titan X card with a mighty cooler to go with it. The company plans to sell the ZOTAC Titan X With ArcticStorm, its combo liquid/air cooler that comes with 6mm copper heatpipes and a copper waterblock, a wide aluminum fin cooling stack, and three 90mm fans. The entire cooling apparatus is wrapped in a metal fan shroud and back plate. The Titan X With ArcticStorm card comes with 12GB of memory, too. No price available yet, but plan on bringing your folding money.



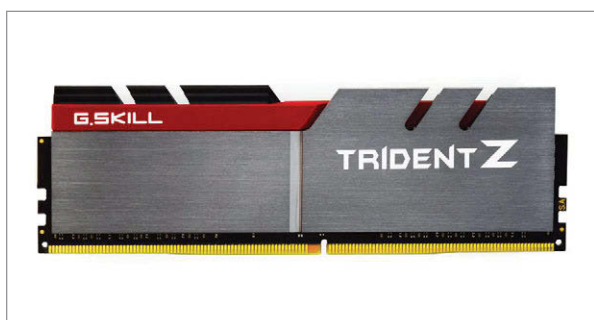
Antec Makes Big, Bold Statement With Signature Series S10 Chassis

Antec's Signature Series S10 is a big case with a new design that breaks up airflow into three distinct chambers for the motherboard, hard drives, and PSU. The rolled steel chassis has brushed aluminum side doors that swing open; there's a ventilated top panel and seven fans (and plenty of room for radiators for liquid cooling). With 10 PCI-E slots, the S10 can handle up to four 13.5-inch PCI-E graphics cards for quad SLI. The case measures 23.7 x 9.5 x 23.2 inches (HxWxD). Antec's S10 offers thoughtful cable management, four top-mounted USB 3.0 ports, and more. MSRP is \$499.



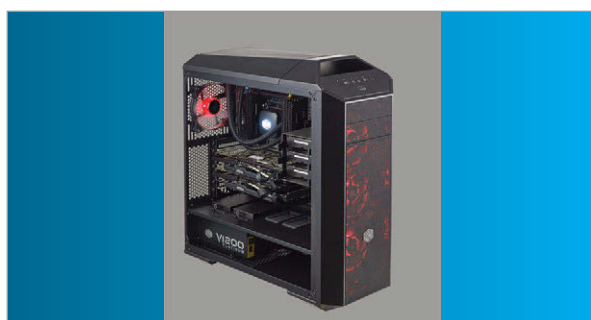
G.Skill Announces New Trident Z DDR-4 Memory For PC Enthusiasts

The Trident and Trident X DDR3 memory brands are well-known to power users. At COMPUTEX, G.Skill announced the next model in the series, the Trident Z. Trident Z uses DDR4 memory; the 16GB demo kit we saw was running 3666MHz at 1.35V with CL18-18-18 settings. Trident Z features an aluminum heatspreader with angled notches and a top bar that can be customized to match your build's color scheme. Trident Z will be available in both dual channel and quad channel kits later this month. Pricing on the new memory kits was not yet available as we went to press.



Cooler Master Announces New Cases Based On Modular Design

Cooler Master has unveiled several new case models, including the MasterCase 5, MasterCase Maker 5, and MasterCase Pro 5 (shown below), that derive from a totally modular concept of building cases. The company began with a MasterConcept case and then spun out the new models in the MasterCase series; each model can then be customized in additional ways on the interior as well as exterior by end users. The company says its MasterConcept envisions a unique case for every end user. The new MasterCase 5 and MasterCase Pro 5 models will be available in August.



Raijintek CRATUS Case Packs In Options For MicroATX/ATX Systems

Raijintek, a Taiwan-based maker of cases, cooling components, and other computing accessories, is branching out to the U.S. with new products such as the CRATUS. This case measures just 21.5 x 8.7 x 20.3 inches (HxWxD) but fits in 8 PCI-E slots, 6 x 3.5-inch and 2 x 2.5-inch drive bays, and a 5.25-inch bay for an optical drive. It can handle CPU coolers up to 180mm and graphics cards up to 340mm, and can hold radiators up to 360mm at the front and top. CRATUS has 4 USB 3.0 ports, is tool-free and comes in two colors: matte black and white. Price is not yet available.



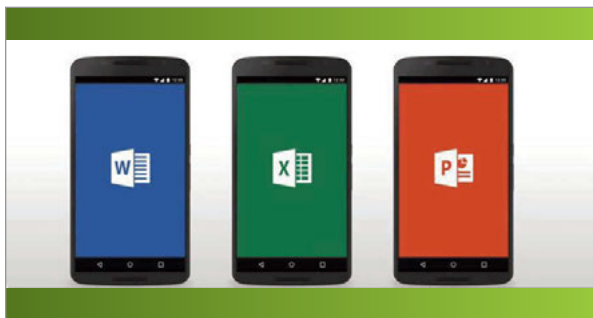
OCZ Announces New SSD Line; Trion 100 Uses Triple-Level NAND

Users looking to upgrade mobile or desktop HDs to SSDs will have another option soon. OCZ has announced a new line of SATA SSDs called the Trion 100 that will make use of TLC (Triple-Level Cell) NAND memory. The new drives have a Toshiba controller and are being positioned by OCZ as entry level drives that offer superior performance for the money. OCZ says its preliminary performance ratings show the TRION provides "up to 550MB/s of bandwidth and up to 91,000 random read IOPS." The TRION 100 will go on sale later this summer; pricing is currently not available.



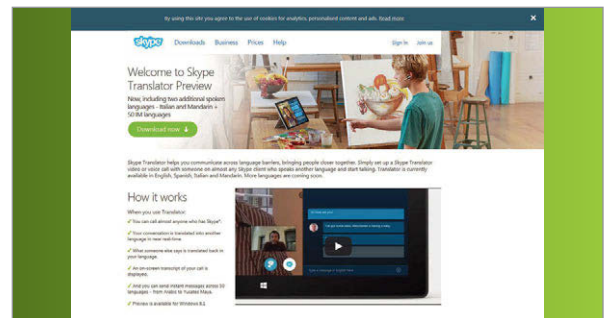
Microsoft Word, Excel, Powerpoint Apps Now Available For Android

Apps for the world's most widely used productivity software are now available for Android users. Microsoft has made individual Word, Excel, and PowerPoint apps available for download on the Google Play Store. The app descriptions stress these are the "real" versions of Microsoft's popular products. Best of all, they're available for free (but you will need to have an Office 365 subscription to have the "full Office experience" or to use the apps on screens larger than 10.1 inches). Smartphone users will need at least 1GB of RAM and a KitKat 4.4 or later version of Android.



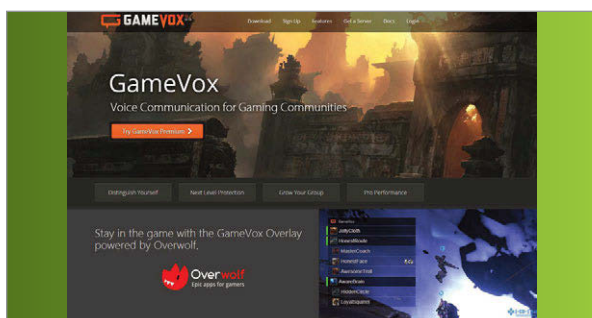
Try Skype Translator Beta For Free

Microsoft is letting users try a preview of its Skype Translator product for free. The software works with Skype, Microsoft's product for making video and voice calls over the Internet. Make a call to a friend who speaks another language, and Skype Translator will translate (or do its best to translate) your words to that person's language in real time, and vice versa. You also will see a written transcript of the conversation. Translator handles spoken Spanish, French, German, Italian, Mandarin, and English. If you use it when instant messaging, the service works in dozens of additional languages, about 50 in all. Go to www.skype.com/en/translator-preview for the download.



GameVox Gives Gamers Control Over Their Voice Communications

Gamers who have always wanted more control over their communications setup will want to check out GameVox, a new hosting service for voice communications. With GameVox, you select a server package based on the size of your group. The Basic package for up to six users is free; 25 users is \$10/month; 50 users is \$15/month; and 200 users is \$20/month (and prices are now reduced at www.gamevox.com). The package includes a server you can customize, and you can give users their own badges and icons. GameVox lets you instant message, have private chat rooms, and more.



GM Plans To Add Apple Carplay & Android Auto To 2016 Cadillacs

General Motors recently announced it would be making Apple Carplay and Android Auto available in 2016 models for Cadillac. The two programs provide drivers with in-car phone integration and other services and work through CUE, Cadillac User Experience software. Apple phone owners can make phone calls and make music requests through Carplay using a touchscreen or the Siri voice app; similarly, Android phone users can communicate using Google's various products and get access through Android Auto to Google Maps, Google Music Play, and other applications.



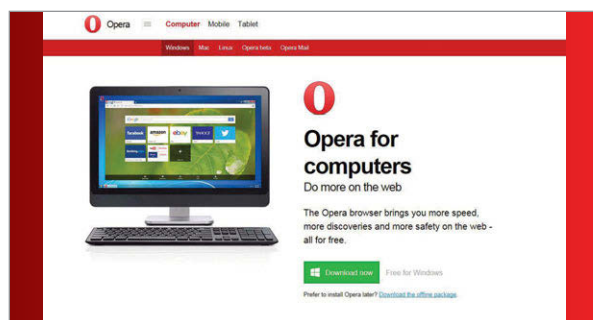
Now You Can Browse & Buy Copies Of Your Favorite NASA Space Pix

A private company called Luna Imaging has gathered dozens of collections of NASA photos in one place online and provided an easy-to-use interface to find particular images. More than 100,000 photos, including famous historical shots as well as more recent images, are available on the site. You can browse through images grouped by subject matter (Earth, Astronauts, Robotics, and so on) or look for something more specific via a search bar. Find something you like and you can order prints at various sizes and price points. Check it out at <http://nasaimages.lunaimaging.com>.



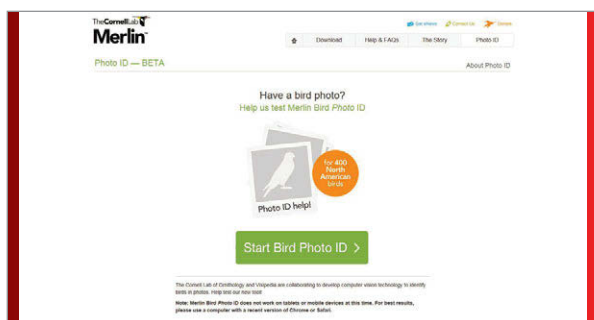
Opera Release 30 Now Available: The "Fast & Free" Alternative

Norwegian developer Opera Software positions its namesake product as the "fast and free alternative web browser," and that pitch has helped Opera grow from an obscure program to one of the most popular browsers among power users. Now the latest version of Opera, release 30, is available for download. Opera says version 30's new features include an enhanced tab menu, a trash folder for bookmarks, an extensions sidebar, synched browser settings, and support for HTML 5 MSE/H.264. You can get a copy for yourself at the company's website at www.opera.com.



Cornell's New Merlin Photo Website Is One For The Bird(watcher)s

Researchers at Cornell University have an app called Merlin that helps people identify bird species by answering a set of questions. Now they have teamed with Visipedia, a joint project between Cornell and Caltech, to create a website that will identify birds in photos that people upload. Just go to <http://merlin.allaboutbirds.org/photo-id> (note, the site only works right now with computers, not with phones or tablets) and upload a photo of a North American bird, and the Merlin ID program will do its best to tell you which of 400 species is in the picture.



MLG Set To Celebrate Milestone: New Orleans To Host 100th Event

MLG (Major League Gaming) is one of the better known organizations in eSports. The digital gaming league promotes computer and console game playing and holds professional and semi-professional level tournaments worldwide. Now MLG is gearing up to celebrate a major milestone: its 100th tournament event. The tournament will be held this October in New Orleans, and feature DOTA2 and Call Of Duty players who will vie for more than half a million dollars in prizes. You can watch the action online, but if you want to see it live, go to www.majorleaguegaming.com for tickets.



SAPPHIRE R9 300 NITRO Series

A Card For Every Gamer

AMD recently launched its R9 and R7 300-series GPUs, with a raft of new features and greater power efficiency than their R9 and R7 200-series predecessors. These graphics chips come with support for DirectX 12, Vulkan, and Mantle, and in general they have bigger frame buffers and faster memory interfaces than the last generation of AMD GPUs.

In and of themselves, each of these factors would point to improved graphics performance and a better all-around experience, but SAPHIRE has given four of these new graphics chips even more power and flexibility, creating its all-new NITRO series of graphics cards in the process. The NITRO family will include R7 360, R7 370, R9 380, and R9 390 models.

What NITRO Means

“SAPHIRE NITRO is designed to address the majority of PC gamers,” says SAPHIRE’s Ed Crisler. “Generally, when companies bring a ‘gamer’ product to market, they throw on some lights, add a loud aesthetic design, and then charge a premium price because it’s for ‘gamers.’ From the start, we did not want to go in this direction.

“We began with the base premise of building the highest-quality card we could make without charging a premium price. Gamers do not want to spend extra for the ‘gamer’ tag, and we are not going to make them pay a tax for it.”

Instead, the company took its already highly effective heatpipe coolers and tweaked them to ensure that all NITRO

cards would not only stay cool under fire, but would also stay quiet, even during intense gaming. All NITRO cards are also equipped with high-quality 16,000-hour capacitors and award-winning Black Diamond Chokes, so they will remain stable and last a long time.

Crisler says SAPHIRE’s design team also gave the NITRO-series cards stiffer construction without the added expense of backplates, which are the usual way manufacturers reduce flex to protect a card’s PCB.



SAPHIRE NITRO R9 390

“We wanted to avoid adding cost to these cards, so we redesigned how the shroud attaches to the card so that the shroud itself helps stiffen the PCB instead,” Crisler says.

Of course, good looks don’t hurt, so the NITRO series got some special attention in this area, as well.

“We did not want the blingy, over-the-top look that others go for in ‘gamer’ products,” Crisler explains. “The time we’ve spent talking to gamers bears this out, as most favor a simpler design. With this in mind, we created a



SAPPHIRE NITRO R9 380

interfaces than their 200-series predecessors, SAPPHIRE's 300-series R7 and R9 cards offer support for two key technologies: DirectX 12 and FreeSync.

"DirectX 12 has the potential to be a real game-changer, if you'll pardon the pun," Crisler says. "It could completely change the way the GPU interacts with PCs and opens a lot of possibilities for developers. The great news is that all of the latest R300 cards are DX12-ready.

"To me, one of the most exciting changes is the way it will alter how multi-GPU configurations interact. The ability to independently make use of each card is exciting, and I am anxious to see how game developers make use of it."

Crisler says that he initially underestimated the impact of FreeSync, but now that he's seen it in action, he's a believer.

"FreeSync is an amazing technology that really does improve the gaming experience," Crisler says. "I would wholeheartedly suggest that anyone who can afford it move to a FreeSync monitor. In my work, I have at my disposal a number of monitors in a lot of different shapes and sizes. In the end, however, my gaming rig for personal use has a FreeSync LG UltraWide. Once you use one, it is hard to go back."

Power To The People

SAPPHIRE's NITRO-series R300 cards are available in a broad range of prices, for a broad range of users and for various types of games. The company's dependable, no-frills, high-performance approach focuses on the things that matter most, and that's not a coincidence.

"SAPPHIRE NITRO is a series of cards designed for the majority of PC gamers, no compromise, no BS," Crisler says. "We collected an enormous amount of feedback before designing this lineup. Our social media team, professional gaming contacts, and LAN part efforts all brought in data from the wide, diverse world of PC gaming. As a member of that world and a hardcore gamers myself, I am really proud of what we have achieved." ■

look that is elegant in its simplicity. The lines are clean and simple, with a base black color and gunmetal highlights. The result is a look that goes with pretty much any build. We took it a step further and blackened our I/O plate, as well; this allows the card to blend into most builds even when viewed from the back of the case."

Which NITRO Is Right For You?

With four NITRO cards to choose from, choosing the one that's right for you might seem a daunting task. Not so, says Crisler.

"To help people understand which one is best for them, we are introducing the SPI, or SAPPHIRE Performance Index," he says. "This is a simple numbering system that represents the performance needed for various gaming styles and is derived from real-world testing done in-house.

"For example, the SAPPHIRE NITRO R7 360 has an SPI rating of 1. This means the card is good for budget- or entry-level

gaming, providing a solid gaming experience at 1080 with some detail reduction. Also, it is a great card for the MOBA player."

Moving up the line, Crisler says that SPI 2 cards such as the NITRO R7 370 are for gamers who want more from their gaming experience, allowing for better detail in 1080 gaming as well as pushing some of the newer triple-A titles well in lower detail settings.

"SPI 3 takes 1080 gaming to high detail pretty much across the board, allowing for a great gaming experience," Crisler says. "To me, this is the sweet spot."

In SAPPHIRE's system, the NITRO R9 380 is an SPI 3 card.

An SPI 4 card (like the NITRO R9 390) lets you max everything out at 1080 and performs amazingly, letting you push upwards into 1440 resolutions with a great gaming experience.

Beyond The Silicon

In addition to packing more video memory and having faster memory



Job Of The Month

Box is a young content management company that gives users a secure way to store and access files from any platform. The company is looking for an Android Software Engineer to help bring Box's services to people who use all types of Android devices. You'll be part of a team working with device manufacturers and telcos, creating technology for the latest mobile products. You should be a Java ninja, have at least a year of experience developing Android apps, and possess a 4-year degree in CS from a hot-shot program. Box wants talented, creative, passionate folks that will drive the business forward. Perks include free lunches, shuttles to and from San Francisco, weekly yoga classes, and other goodies. For more details, see a full description of this position and others at www.box.com/careers.

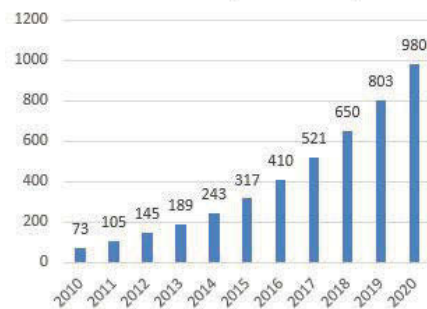
Source: www.box.com

Rise Of The IoT Machines

If you want to know how far off we are from a true "Internet Of Things," just keep an eye on how many devices can remotely connect to the Internet without human intervention. The real power in tech, as every sci-fi junkie knows, lies in the network, and before our current entertainment and productivity devices morph to become our new overlords, they will have to communicate without our help. Drawing on data from GSMA Intelligence, research firm Emarketer says the growth in M2M (machine to machine) mobile connections is increasing rapidly, from about 73 million in 2010 to an estimated 980 million in the next five years. At that point, M2M will represent 10% of all mobile connections.

Source: GSMA Intelligence via Emarketer

Growth Forecast For
Machine-To-Machine Mobile
Connections (In Millions)



Whom Do You Trust To Keep Your Records Private?

A survey of U.S. adults by Pew Research reveals most people don't believe the companies and sites they do business with will be able to protect their data. When asked whether they were "very confident, somewhat confident, not too confident, or not at all confident" that companies and websites would keep their data private and secure, only a minority reported feeling confident at all about data security.

Percentage Of U.S. Adults Who Are Very Confident/Somewhat Confident That The Following Institutions Will Keep Their Private Records Safe

Credit Card Companies	38%	Companies/Retailers You Use	26%
Government Agencies	31%	Search Engines	16%
Landline Phone Companies	31%	Online Video Sites	11%
Cellphone Companies	31%	Social Media Sites	11%
Email Providers	29%	Online Advertisers On Sites You Use	7%
Cable TV Companies	28%		

Source: Pew Research

RAW Numbers:

29%

The percentage of broadband households in the U.S. that have some type of connected health device.

Parks Associates

40%

The percentage of millennials (people ages 18 to 34) who say they are interested in "smart home" products.

NPD Group

\$35 billion +

The estimated financial cost borne by businesses as a result of the document leaks Edward Snowden made concerning U.S. government surveillance programs. Due to the revelations made in the documents, many businesses and foreign entities decided not to buy U.S. technology products. The Information Technology & Innovation Foundation now says its original estimate of \$35 billion damage was too low, and the total is likely to "far exceed" that amount by the end of 2016.

Information Technology and Innovation Foundation, via The Wall Street Journal

\$70 billion

Forecast total of annual global revenues from shipments of residential Internet-of-Things devices by 2025.

Navgant Research

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Trust is important when it comes to choosing the right server provider. With 13 years of server experience and 6,000 employees in 11 countries, 1&1 is one of the largest Internet service providers in the world and a company you can rely on. Benefit from our expertise and the maximum security offered by our high-tech data centers.



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NITRO R9 380 4GB
\$219.99
SAPPHIRE
www.sapphiretech.com

SAPPHIRE NITRO R9 380 4GB

Of the two SAPHIRE NITRO Series cards featured in this issue, the R9 380 4GB leverages the newer architecture. That said, it's still not completely new; the GPU in this graphics card is nearly identical to the one used in the Radeon R9 285, which launched less than a year ago under the codename Tonga. This card's 28nm GCN 1.2-based GPU, code-named "Antigua," features 5 billion transistors, 1,792 stream processors, 112 texture units, and 32 ROPs. Compared to GCN 1.1-based GPUs like those on the Radeon R9 390 and 390X, it is capable of parallel instruction processing between SIMD lanes, better compute task scheduling, and enhanced compute and media processing capabilities, thanks to a new set of 16-bit floating-point and integer instructions.

As with the other SAPHIRE NITRO card we looked at, the biggest new features are its cooler and board. There are metal plates on the top and bottom edges of the cooler, with the SAPHIRE logo painted onto the top piece. The heatsink is threaded with copper heatpipes and a thick copper plate rests against

the GPU. The memory chips and VRM also make contact with the heatsink via the thermal pads between them, ensuring this card keeps cool when you're pushing it hard. There are two quiet-running 100mm fans on this card and they remain motionless until heavily loaded, thanks to the IFC-II (enhanced Intelligent Fan Control) technology. Each fan also features dual ball bearings, which provide longer effective lifespans and greater reliability. All that cooling power will come in handy, considering SAPHIRE ships this card with a factory overclock of 985MHz for the core. The memory clock is set to 1,450MHz, and it runs on a 256-bit bus with 4GB of GDDR5 for the frame buffer, which is a must-have for gamers who want to play at resolutions higher than 1080p.

According to SAPHIRE, the Black Diamond chokes it uses on the NITRO Series cards operate 10% cooler and are 25% more energy-efficient than typical chokes. The firm also uses 16,000-hour capacitors, which ensures your card will continue running reliably for longer than you'll ever need it to.

Specs & Scores	SAPPHIRE NITRO R9 380 4GB
Price	\$219.99
Core clock	985MHz
Memory clock	1,450MHz
Memory interface	256-bit
Memory	4GB GDDR5
3DMark Professional (Fire Strike)	3704
Graphics Score	3815
Physics Score	15379
Unigine Heaven 4.0	(1,920 x 1,080)
Score	805
FPS	32
Games	(1,920 x 1,080)
Metro: Last Light (DX11, V. High, 16XAF, V. High Tess.)	54.67fps
Aliens vs. Predator (V. High, 16XAF, 4XAA, SSOA)	62.5fps
Dying Light (Medium, AO On, AA On, Vsync Off)	64fps
The Witcher III: Wild Hunt (Vsync Off, Unl. FPS, High)	51.6fps

The card measures a hair under 9.5 inches long, making it good for smaller form-factor chassis, though the cooler extends above the bracket by nearly an inch, to accommodate the large diameter fans. You'll need a pair of 6-pin PCIe power connectors to run this card and at least a 500-watt power supply. The back bracket accommodates dual-link DVI-I, DVI-D, mini HDMI, and DP output to a monitor.

In the benchmarks, 1,920 x 1,080 seemed to be where this card performs best. Scores in Dying Light were very respectable at both the low and high resolutions, though if you plan to play more demanding games like The Witcher 3: Wild Hunt, plan to reduce settings or limit your resolution to 1080p to get the best experience.

Gamers looking for a lot of performance for not a lot of scratch will find lots to love about SAPHIRE's NITRO R9 380. ■

BY ANDREW LEIBMAN

Specs: GPU: 28nm Antigua (Tonga Pro); Clocks: 985MHz core, 1,450MHz memory; Memory Bus: 256-bit; Frame Buffer: 4GB GDDR5; Factory Overclocked: Yes; Ports: dual-link DVI-I, DVI-D, Mini HDMI, DisplayPort
Test system specs: Processor: Intel Core i7-5960X; Motherboard: GIGABYTE X99-Gaming G1; RAM: 16GB Ballistix Elite DDR4-2400; Storage: 240GB OCZ Vertex 3 MAX IOPS SSD; OS: Windows 8 Enterprise (64-bit)



NITRO R9 390 8GB
\$329.99
SAPPHIRE
www.sapphiretech.com

SAPPHIRE NITRO R9 390 8GB

If you were starting to wonder what AMD had been up to since late 2013, the Radeon R9 300 Series is here to answer that burning question. Our first look at the slightly tweaked Hawaii Pro GPU, now code-named “Grenada,” comes courtesy of SAPHIRE.

Before we dig into what makes this card special, let’s touch on the GPU under the hood. This 6.2-billion-transistor chip is manufactured using the same TSMC 28nm process that AMD has been relying on for the past several years and it’s based on an architecture that has also not changed much. Despite its new codename, this is still a GCN 1.1 card, and its performance will look awfully familiar. The GPU features 40 compute units for a total of 2,560 stream processors, 160 texture units, and 64 ROPs, which mirrors that of the Radeon R9 290. The memory subsystem maintains the same 512-bit-wide bus, but here there’s 8GB of GDDR5 installed and the memory clocks are also a good bit higher than they were last generation. SAPHIRE gives the NITRO R9 390 the factory OC treatment by boosting the core

clock to 1,010MHz. The memory clock is set to a speedy 1,500MHz.

As we’ve come to expect from SAPHIRE, the heatsink and PCB of this card are a cut above. The NITRO’s black plastic heatsink shroud has brushed, matte, and glossy highlights as well as a couple embedded metal plates. This is the latest version of SAPHIRE’s Tri-X cooler, but this time around, the three 90mm fans are dual-ball bearing fans that offer a long lifespan. The fans also stop spinning when the card’s idle or running under light load, a feature SAPHIRE is calling IFC-II, or enhanced Intelligent Fan Control. The heatsink features five copper heatpipes, up to 10mm in diameter. Although there’s no backplate, the card’s heatsink fins are bolted to a die-cast frame that aids heat dissipation and makes this one of the most rigid cards we’ve ever tested. On the PCB, SAPHIRE uses long-life capacitors and Black Diamond chokes for consistent performance you can count on.

Other highlights include full support for DirectX 12, TrueAudio, AMD FreeSync,

Specs & Scores	SAPPHIRE NITRO R9 390 8GB
Price	\$329.99
Core clock	1,010MHz
Memory clock	1,500MHz
Memory interface	512-bit
Memory	8GB GDDR5
3DMark Professional (Fire Strike)	5097
Graphics Score	5209
Physics Score	15981
Unigine Heaven 4.0	(1,920 x 1,080)
Score	1244
FPS	49.4
Games	(1,920 x 1,080)
Metro: Last Light (DX11, V. High, 16XAF, V. High Tess.)	79fps
Aliens vs. Predator (V. High, 16XAF, 4XAA, SSOA)	104.8fps
Dying Light (Medium, AO On, AA On, Vsync Off)	99fps
The Witcher III: Wild Hunt (Vsync Off, Unl. FPS, High)	75.4fps

and gaming at higher resolutions, up to and beyond 1440p. The card measures 12 inches long, and the back bracket features one DVI, one HDMI, and three DP outputs. To feed this beast, you’ll need two 8-pin PCIe power connectors, and AMD recommends a 750-watt or greater power supply.

This card scored playable frame rates in all of our benchmarks. At 2,560 x 1,600, the NITRO R9 390 scored 48.67fps and 51.7fps in Metro: Last Light and Witcher 3: Wild Hunt, respectively, and these are arguably two of the most demanding games currently on the market. If you skipped AMD’s 200-series cards and are looking for something that can handle higher resolutions without costing a small fortune, then the NITRO R9 390 8GB from SAPHIRE is a solid buy. ■

BY ANDREW LEIBMAN

Specs: GPU: 28nm Grenada Pro (Hawaii Pro); Clocks: 1,010MHz core, 1,500MHz memory; Memory Bus: 512-bit; Frame Buffer: 8GB GDDR5; Factory Overclocked: Yes; Ports: dual-link DVI, mini HDMI, three DisplayPort

Test system specs: Processor: Intel Core i7-5960X; Motherboard: GIGABYTE X99-Gaming G1; RAM: 16GB Ballistix Elite DDR4-2400; Storage: 240GB OCZ Vertex 3 MAX IOPS SSD; OS: Windows 8 Enterprise (64-bit)

**Core X2**

\$129.99

Thermaltake

www.thermaltakeusa.com

Thermaltake Core X2

In our February issue (page 23, to be exact), we took a look at Thermaltake's Core X9, a massive elongated cube of a case that will accommodate everything you throw at it, including E-ATX motherboards, elaborate liquid-cooling setups, and more. If you've seen the Core X9 and like the cut of its jib but are looking for something a little more restrained, the Core X2 might be for you.

That's not to say that the Core X2 is tiny; it's still 18.3 inches tall, 12.6 inches wide, and 21.3 inches deep, but it's not as massive as the Core X9 and is considerably more manageable when it's time to head out for a LAN party (or just to rearrange the computer desk). If you're wondering what you have to give up for this decrease in footprint and increase in portability, here it is: Unlike its cavernous big brother, the X2 does not support E-ATX or ATX motherboards.

You can install any Mini-ITX or mATX board, however, and the selection of great boards that leaves available to you

is impressive indeed. Plus, you can install graphics cards up to 12.9 inches long and CPU coolers up to 9 inches high, as well as power supplies up to 8.6 inches long. In other words, aside from your motherboard, everything can be full-sized.

You also don't have to compromise on cooling, as the Core X2 supports radiators up to 360mm long behind its front, top, bottom, and left and right side panels. (Purchasing an additional mesh side panel is required to install a radiator on both side panels simultaneously.) So, lots of very big radiators, any way you slice it, and this means by extension that there are a ridiculous number of fan mounts in the case, as well. The Core X2 comes with a single 120mm fan up front and another in the rear, but you can put as many as three 120mm fans up front, or you can install two 140mm units or a single 200mm monster fan. Similar options on other panels abound, leading to a maximum number of fans that reaches 19. There's also plenty of room for

pumps and reservoirs in the roomy space between the inside of the front panel and the motherboard tray.

Naturally, a case this size provides plenty of storage options, as well. There are three 5.25-inch drive bays with external access from the front and four internal drive bays that hold either 3.5-inch or 2.5-inch drives, and you can mount another three 2.5-inch drives to vertical mounting panels that attach to the main support rails in the case. All of these items are completely modular, so you can take any or all of them out if you prefer elbow room to drive bays. We love this approach, as it allows you to adapt your system's interior to hold just the stuff you need and not waste any space on stuff you don't.

Out of the box, the Core X2 comes with a single windowed side panel installed on its left side and a mesh side panel on the right. You can order another of either type of panel in case you'd like your Core X2 to have both sides windowed or meshed. (Dual window panels are really cool for this case, especially if you've taken your time on the inside.) Regardless of which panels you choose, though, Thermaltake has another hit with the Core X2. Motherboard restrictions aside, there's really nothing it won't do. ■

BY CHRIS TRUMBLE

Specs: Dimensions: 18.3 x 12.6 x 21.3 inches (HxWxD); Materials: SPCC steel; Motherboard support: Mini-ITX, microATX; Drive bays: 3 x 5.25-inch external, 4 x 3.5/2.5-inch internal, 3 x 2.5-inch internal; Fans (included): 1 x 120mm front, 1 x 120mm rear; Fans (optional): 3 x 120mm or 2 x 140mm or 1 x 200mm front, 6 x 120mm or 2 x 140mm or 2 x 200mm top, 1 x 140mm rear, 6 x 120mm bottom, 3 x 120mm left side, 3 x 120mm right side; Ports: 2 x USB 3.0, audio I/O



GeForce GTX 980 Ti

\$679.99

PNY

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PNY GeForce GTX 980 Ti

NVIDIA recently launched a new flagship, the GeForce GTX 980 Ti, which will sit roughly between the uber-powerful—and expensive—TITAN X and the GeForce GTX 980, both in terms of price and performance. Despite sharing the latter card's namesake, the GTX 980 Ti is actually a direct sibling of the TITAN X due to the fact that both employ the GM200 Maxwell GPU, although the GTX 980 Ti's version has been hobbled somewhat. PNY sent us a reference design GeForce GTX 980 Ti; reference cards like this one were the only variants available as we went to press.

The GPU in the GTX 980 Ti is manufactured using the same 28nm process as the rest of the Maxwell-based GeForce 900 Series cards, but this one has 8 billion transistors at its disposal. There are 22 active streaming multiprocessor units in the GTX 980 Ti's GPU (the TITAN X has 24), which gives the card 2,816 CUDA cores, 176 texture units, and 96 ROPs. PNY's card is a reference design even down to the clock speeds: It has a 1,000MHz core clock, 1,075MHz boost clock, and a 1,752MHz memory clock.

Aside from the brute force of more CUDA cores, the GTX 980 Ti further distances itself from the vanilla GTX 980 with its more powerful memory subsystem.

This card features a 384-bit memory bus and a 6GB GDDR5 frame buffer.

The heatsink on this card will be familiar to anyone who has previously owned a GeForce GTX 780, GTX 780 Ti, or GTX TITAN Black. It's virtually identical to the TITAN X's cooler, except this card has a two-tone silver and black finish. This is a blower-style cooler, with a radial fan on the right side of the card that forces air through a mostly enclosed heatsink that sits atop a vapor chamber coldplate. The cast aluminum heatsink shroud is bolted to the card with hex nuts, and there's a clear plastic window over the large heatsink. A textured black finish rings the radial fan and wraps around the sides of the card. There's a green backlit GeForce GTX logo on the top edge of the card, and although green tends to clash with modern motherboard and memory heatsink colors, we love being able to play with the backlighting effects using GeForce Experience utility.

The GeForce GTX 980 Ti is 10.5 inches long and requires 8-pin and 6-pin PCIe power connectors to run. NVIDIA recommends a 600-watt power supply at minimum to run this 250-watt graphics card. On the back bracket, you'll find dual-link DVI-I, HDMI, and a trio of DisplayPort outputs. One way

Specs & Scores	PNY GeForce GTX 980 Ti
Core clock	1,000MHz
Boost clock	1,075MHz
Memory clock	1,752MHz
Memory interface	384-bit
Memory	6GB GDDR5
3DMark Professional (Fire Strike Extreme)	7476
Graphics Score	7735
Physics Score	16189
Games	(1,920 x 1,200)
Aliens vs. Predator (V High, SSAO, 4XAA, 16XAF)	140.3fps
Metro: Last Light (DX11, V High, 16XAF, V High Tess.)	109.33fps
Dying Light (Med, AO On, AA On, Vsync off)	136.9fps
Witcher 3: Wild Hunt (Vsync off, Unl. fps, Ultra)	78.7fps
	(2,560 x 1,600)
Aliens vs. Predator (V High, SSAO, 4XAA, 16XAF)	80.4fps
Metro: Last Light (DX11, V High, 16XAF, V High Tess.)	66.67fps
Dying Light (Med, AO On, AA On, Vsync off)	87.33fps
Witcher 3: Wild Hunt (Vsync off, Unl. fps, Ultra)	56.5fps

PNY distinguishes itself from others selling identical cards is with its limited lifetime warranty, which goes into effect once you register the card on PNY's website.

When we put this card to the test, we soon realized that there are very few games that will really make it break a sweat. Even at 2,560 x 1,600, this card runs demanding games like The Witcher 3: Wild Hunt, with the settings at Ultra, at close to 60fps. For those looking for TITAN X-like performance and support for true 4K gaming, but with a more manageable price tag, the GeForce GTX 980 Ti is your best choice. ■

BY ANDREW LEIBMAN

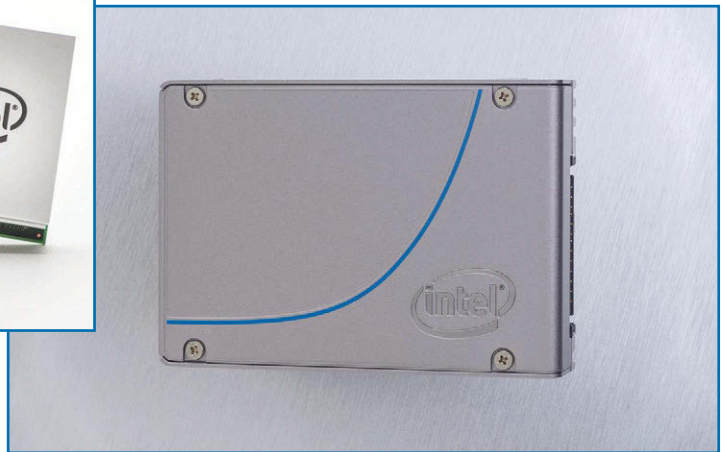
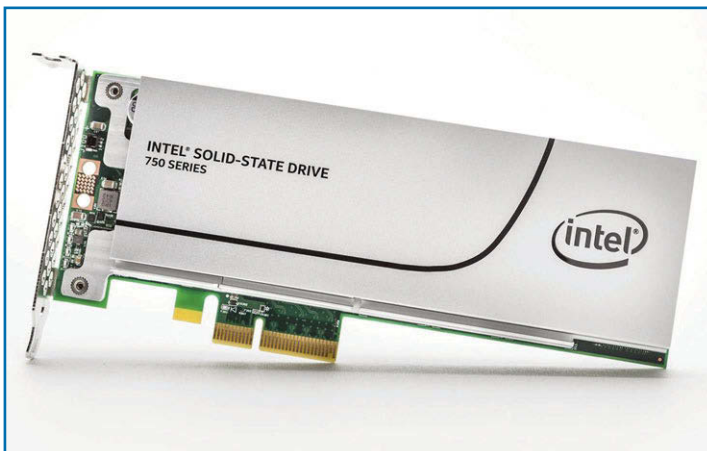
Test system specs: Processor: Intel Core i7-5960X; Motherboard: GIGABYTE X99-Gaming G1; RAM: 16GB Ballistix Elite DDR4-2400; Storage: 240GB OCZ Vertex 3 MAX IOPS SSD; OS: Windows 8 Enterprise (64-bit)

Intel® SSDs

The Right Tools For The Job

You know all about the advantages of using SSDs vs. traditional hard drives. You know that PCs equipped with SSDs boot faster, load apps faster, and in general are more responsive. You also know SSDs are quieter than hard drives, and that they are more energy efficient and longer lasting. And because they have no moving parts, SSDs are considerably more durable than their mechanical counterparts.

But where SSDs are concerned, one size does *not* fit all. As with other important components in your system, you have a lot of options when it comes time to choose a boot drive, and the choice you make will have a profound impact on your system's performance and overall cost.



Intel SSD 750 Series High-End Gaming & Content Creation Workstations

Intel's 750 Series SSDs are the pinnacle of solid-state drive evolution, delivering cutting-edge PCIe performance, the industry's first-ever NVMe support in consumer drives, and Intel's legendary reliability. The 750 Series currently includes two form factors: an HHHL AIC (half-height half-length add-in-card) drive that plugs into an open PCIe 3.0 x4 expansion slot, and a 2.5-inch Small Form Factor 8643 unit that uses Intel's u.2 interface. Whichever drive you choose, you'll benefit from the greater bandwidth provided by four lanes of PCI-E 3.0.

In addition to the greater bandwidth provided by PCIe vs. the 6Gbps SATA interface, these drives benefit from NVM Express, a logical device interface designed to work specifically with non-volatile memory storage devices. NVMe takes advantage of the lower latency and parallelism that SSDs offer, resulting in much-improved performance.

Both 750 Series form factors are available in two capacities: 400GB and 1.2TB (for both form factors). The 400GB drives produce sustained sequential reads and writes of 2,200MBps and 900MBps, respectively, while the 1.2TB drives read and write at 2,400MBps and 1,200MBps. The 400GB drives produce random 4KB reads and writes of 430,000 IOPS and 230,000 IOPS, while the 1.2TB drives put up random 4K numbers of 440,000 IOPS (reads) and 290,000 IOPS (writes).



Intel SSD 730 Series Enthusiast Systems & Office PCs

The 730 Series solid-state drives combine Intel's own third-generation controller, the same blisteringly fast 20-nanometer Intel NAND flash memory you'll find in the newer 750 Series drives, and firmware that is optimized for performance. 730 Series drives are more than just the sum of their parts, though, as Intel factory-overclocks the 730's components before they find their way to you, bumping up the controller's speed by an additional 50% and adding 20% to the NAND bus speed.

This results in low 50µs read latency, up to 550MBps sequential reads, and random reads reaching 89,000 IOPS. Combining two or more 730 Series drives in a RAID 0 configuration provides even more impressive results, thanks to Intel's Rapid Storage Technology. Connecting two 240GB 730 Series drives in RAID 0 provides the same storage as a single 480GB drive, but almost twice as much throughput in sequential read and write operations. Adding additional drives pushes the 730 Series' performance to even greater heights.

Intel SSD 730 Series drives are 2.5-inch, 6Gbps SATA drives that are available in 240GB and 480GB capacities.

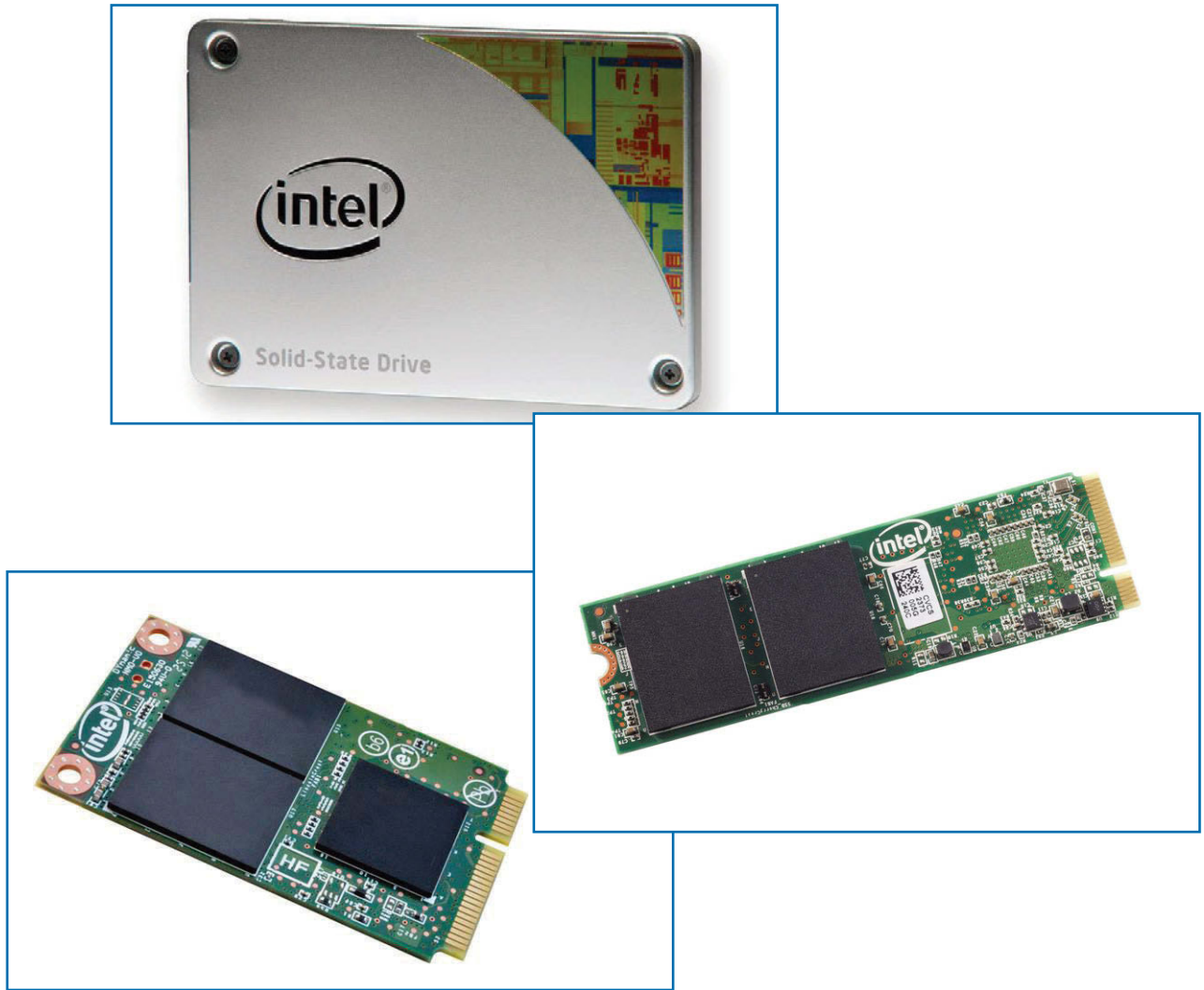


Intel SSD 535 Series Mainstream Systems & Small Form Factor PCs

Intel's 535 Series SSDs' calling card is efficient performance and, in the case of the M.2 form factor, efficient small form factor performance. These drives run on Intel's latest 16nm NAND, and this manufacturing process offers low-power operation and a long lifespan (535 Series drives have a 1.2 million-hour MTBF rating). The 2.5-inch SATA 6Gbps drives are great for household PCs used to surf the web, mainstream games, and perform other general-computing tasks.

The 535 is also available in an M.2 form factor that is a huge space-saver in small form factor PCs, where every inch of interior space counts. These drives are an especially good fit for small, out-of-the-way home theater PCs and for barebones kits, such as Intel's NUC mini-PCs.

Both form factors are available in 120GB, 180GB, 240GB, and 360GB capacities, and the 2.5-inch SATA drive is also available as a 480GB drive. This family of drives provides sequential reads up to 540MBps, sequential writes up to 490MBps, random reads up to 45,000 IOPS (SATA versions achieve random reads up to 48,000 IOPS), and random writes up to 80,000 IOPS.



Intel SSD 530 Series

Small Form Factor PCs, Laptops, Tablets, Ultrabooks

Constructed using Intel's 20nm MLC NAND, the SSD 530 Series family of drives provides reliable, efficient performance in a wide range of system types and for many different applications. 530 Series drives are available in a 2.5-inch SATA form factor (shown at the top above) that comes in 80GB, 120GB, 180GB, 240GB, 360GB, and 480GB capacities. The family also includes M.2 form factor (above right) available in 80GB, 120GB, 180GB, 240GB, and 360GB sizes, and an mSATA form factor (above left) in 80GB, 120GB, 180GB, and 240GB sizes.

The mSATA variant is a great fit for use in laptops and other portable devices, as they take up very little space and weigh considerably less than their larger, 2.5-inch SATA counterparts—up to 10 grams, vs. a 2.5-inch drive that can weigh up to 78 grams. The M.2 and mSATA variants also use less power than a standard 2.5-inch SATA drive; both small form factor parts are rated at 140mW, compared to 195mW for a larger drive. That means that in addition to being more portable, these mighty mites will also help extend the battery life of your mobile device.

Regardless of which form factor you choose, you will enjoy sequential read speeds up to 540MBps, sequential write speeds of up to 490MBps, random reads up to 41,000 IOPS, and random writes up to 80,000 IOPS.

GIGABYTE GA-X99-GAMING 5P

As the gaming-centric member of GIGABYTE's lineup of Champion Series motherboards, the X99-GAMING 5P is actually a new take on an old favorite—as old as any LGA 2011-3 motherboard can get, that is. This board is actually nearly identical to the X99-GAMING 5 motherboard that the company launched earlier this year. In addition to the P suffix appended to the end of this motherboard's model name, GIGABYTE widened the board from 9.6 inches to 10.3 inches, making it an E-ATX form factor board. In doing so, GIGABYTE was able to tweak things here and there and offer enthusiasts a more compelling piece of hardware.

If you're looking at an X99 platform, then memory bandwidth is very important to you, which is why improved and enhanced memory support tops the list of goodies GIGABYTE ported from the X99-SOC Champion to this motherboard. In addition to the stock DDR4-2133 support among the board's eight DIMM slots, new XMP profiles let users install and run a handful of high-end modules at up to 3,333MHz for better performance in memory-intensive workloads. This board supports RDIMM memory, which lets you run 16GB DIMMs, for a total of up to 128GB of memory in your system.

Another new feature that this board has on its résumé is an improved socket, with pins for each of the New Intel Core i7 Extreme Edition processor's pads. Those extra 72 pins enable the processor to improve cache access times and reduce the voltage requirements for the onboard memory controller when running overclocked memory. The aptly named CPU Mode switch has two



positions: its default setting, which is the Intel-certified socket configuration, and the OC mode position, which enables those extra pins. All the manual says about using the switch is that you may experience incompatibility issues, though we didn't run into any problems.

System fan headers on the bottom edge of the motherboard have been moved closer to the right side of the board and the internal USB 3.0 header has been moved adjacent to the 24-pin ATX power connector, which both seem like solid design choices. Aside from these changes, there's very little to differentiate this board from the older one, but many of the features that have been carried over are worth noting.

GIGABYTE's Amp-Up Audio technology is a big draw for gamers and media fanatics, and it's back. This suite

of features consists of the Creative Sound Core3D quad-core audio processor (covered in an attractive gold jacket), Bi-polarized Nichicon audio capacitors, an upgradeable OP-AMP (operational amplifier), gold-plated audio jacks on the I/O panel, and a front headphone/speaker amplifier that supports studio-quality 600ohm devices at the flip of a switch. We also love the audio guard light path, LED-lit PCH heatsink, and the rear panel backlighting.

The storage system on the X99-GAMING 5P is also worth talking about. There are a total of 10 6Gbps SATA ports, one SATA Express port, and a 10Gbps M.2 port for type-2242/2260/2280 storage devices.

Gamers will be happy to learn that this board supports both NVIDIA's SLI and AMD's CrossFire technologies. For those

GA-X99-GAMING 5P | \$309 | GIGABYTE | www.gigabyte.us

installing a Haswell-E with 40 PCIe lanes on offer (the Core i7-5960X or 5930K), this board delivers graphics bandwidth up to 320Gbps instead of the stock 256Gbps, thanks to GIGABYTE's inclusion of an onboard external clock generator and the direct (switchless) connection of one of the x16 lanes to the CPU. This lets you run a 4-way SLI or CrossFire setup at x8/x8/x16/x8, and a 3-way setup at x16/x16/x8. There's a supplemental 4-pin Molex connector on the bottom of the board to make sure you have enough juice to handle such a configuration.

In addition to the audio ports we already mentioned, six USB 3.0 ports (one of which is a Q-Flash BIOS-flashing port), four USB 2.0 ports, and an S/PDIF output, the back panel features an RJ-45 port that connects to a Killer E2200 controller. With the included software, you get Gigabit Ethernet that puts the most latency-sensitive applications at the front of the line to reduce lag in games and multimedia applications.

This wouldn't be a GIGABYTE motherboard if it weren't Ultra Durable. This board was built with 10,000-hour solid-state Durable Black capacitors; 30-micron-thick gold plating on the PCIe, DIMM, and CPU pins; a 2-ounce copper PCB; server level chokes; and Digital PWM and PowIRstage ICs from International Rectifier. The latter are designed to deliver laser-accurate current sensing to regulate the thermal loading across all stages, which makes your board overclock better and run more reliably for a long time.

When it came time to put up or shut up, the system scored a solid 15,745 score in 3DMark's Physics test, which is a good indicator of the CPU performance and memory throughput in a gaming worst case scenario. Other highlights include the 1,321 points from Cinebench, 2,677.32 pixels per second in POV-Ray, and Dhrystone and Whetstone scores of 288.26GIPS and 163.31GFLOPS, respectively.

If you're in the market for a durable and attractive X99 motherboard with

Benchmark Results	GIGABYTE GA-X99- GAMING 5P
3DMark Professional (Fire Strike Extreme)	7471
Graphics Score	7745
Physics Score	15745
PCMark 8	
Creative Score	4823
SiSoftware Sandra 2015	
Dhrystone AVX2 (GIPS)	288.26
Whetstone AVX (GFLOPS)	163.31
Multi-Media Integer AVX2 x32 (Mpixels/s)	445.3
Multi-Media Long-int AVX2 x16 (Mpixels/s)	214.79
Multi-Media Quad ALU x1 (Mpixels/s)	3.3
Integer B/F AVX/128 (GBps, mem bandwidth)	47.68
Floating B/F AVX/128 (GBps, mem bandwidth)	50
POV-Ray 3.7 Beta*	2677.32
Cinebench 15**	1321
Games (2,560 x 1,600)	
Metro: Last Light (16XAF)	81.1
Aliens vs. Predator (4XAA, 16XAF)	69.33
* pixels per second	
** points	

lots of extras for gamers and overclockers, the X99-GAMING 5P is a surefire winner. ■

BY ANDREW LEIBMAN

Specs: Max Memory: 128GB DDR4 (DDR4-2133; Max OC: DDR4-3333); Slots: 4 PCIe 3.0 x16, 3 PCIe 2.0 x1, 1 M.2 Wi-Fi Connector; Storage: 10 6Gbps SATA, 1 SATA Express, 1 M.2 (type 2242/2260/2280); Rear I/O: 2 PS/2, 6 USB 3.0, 4 USB 2.0, audio I/O, 1 optical S/PDIF out, 1 Ethernet; Form Factor: E-ATX; Warranty: 3 years

Test system specs: Processor: Intel Core i7-5960X; GPU: PNY GeForce GTX 980Ti; Memory: 16GB Crucial Ballistix Elite DDR4-2400; Storage: 240GB OCZ Vertex 3 MAX IOPS SSD; OS: Windows 8 Enterprise (64-bit)

ASUS SABERTOOTH X99

In the May issue of CPU, we introduced you to the TUF SABERTOOTH X99 from ASUS, the first motherboard in the world to support all types of NVMe devices, including mini-SAS and SFF-8639 (make that U.2) devices, such as Intel's 2.5-inch SSD 750. (NVMe support is now available on all ASUS X99 boards via UEFI update.) The latter is possible via ASUS' Hyper Kit expansion card (sold separately, \$22.99 online), which converts the SABERTOOTH X99's M.2 port into a port that will accommodate the Intel 750, and presumably any other U.2 devices that come out in the near future. But the sum of this motherboard is more than just a couple futuristic storage interfaces.

As a TUF series motherboard, the SABERTOOTH X99 has several features that make it resilient and reliable. The most immediately visible TUF feature you're likely to notice is the Thermal Armor, which consists of a slate-colored plastic shield that covers the I/O panel, VRM heatsink, and the left edge of the board. A black plastic cover with a diamond plate design covers the area between the expansion slots right up to the PCH heatsink. The board comes with a 40mm fan you can bolt near the I/O panel to reduce temperatures by up to 10%. There's also the Thermal Radar 2, which gives you control over fan speeds and advanced temperature management capabilities, as well as a trio of thermistors that you can use to monitor various components and the ambient case temperatures.

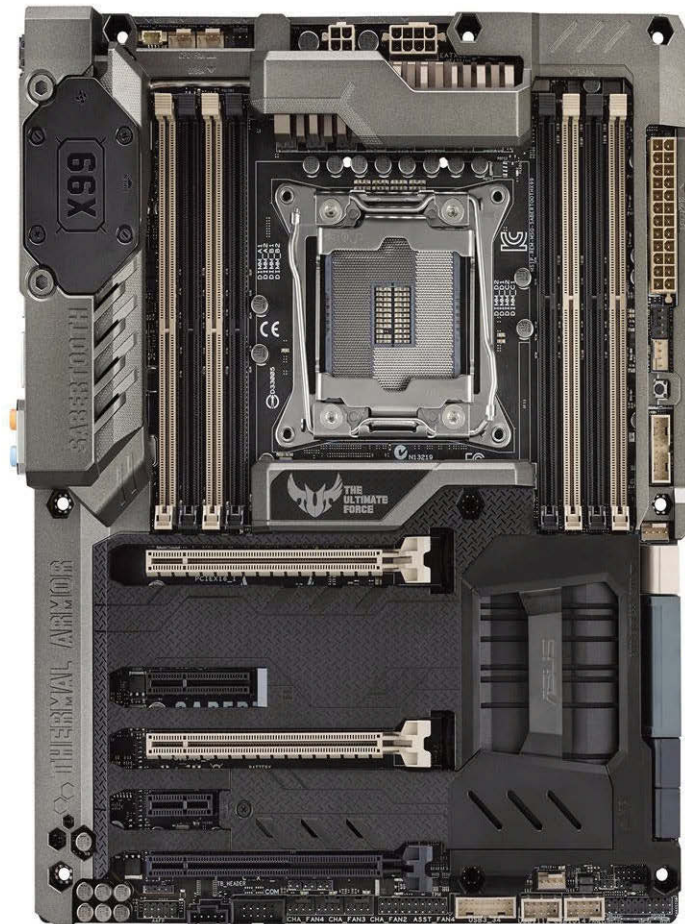
ASUS was the first company to take advantage of the extra contacts on Intel's Haswell-E processors, so it's no surprise that the SABERTOOTH X99 has its own extra-pin-equipped socket, which ASUS calls its OC Socket. This enables higher cache bus frequencies during overclocking for better performance and improved stability. ASUS also claims that its OC Socket maintains a consistent core voltage, while other

motherboards that boast the extra-pin socket tend to suffer voltage drops that can hamper your overclocking efforts.

If you look at the SABERTOOTH X99's specifications, you'll see that the maximum supported memory is DDR4-2400, but overclockers shouldn't fret. According to ASUS, "the SABERTOOTH X99 can handle memory speeds over DDR4-3200, however, on our TUF series of boards, we publish our QVLs (qualified vendors lists) after careful evaluation of the platform's plug-and-play capabilities." In short, the

TUF series is built to perform well right out of the box. If you are into tinkering, you can very easily get much faster DDR4 memory to work.

ASUS also installs its unique TUF ICe Cool processor, which is an integrated circuit that manages fan speed and temperatures. The TUF Fortifier is a 1mm SECC backplate that covers most of the back of the motherboard, complete with thermal pads under the 8+2-phase digital VRM. This feature improves cooling by up to 6 degrees C, and adds some significant rigidity to the board itself. ASUS also equips





SABERTOOTH X99 | \$329.99 | ASUS | www.asus.com

the board with military-grade certified MOSFETs with lower RDS(on), TUF X99 chokes that have a ridged surface for better heat dissipation, 10,000-hour Black Metallic Ti-Cap capacitors, and ASUS' Dust Defenders, which are plastic covers that keep dust out of any ports and slots you aren't using. The TUF ESD Guards 2 ensure that all of the I/O ports are properly grounded so your components are protected against electrostatic discharge. If all of the above hasn't already clued you into the SABERTOOTH X99's toughness, then perhaps the 5-year warranty will.

Other features we want to mention include the pair of USB 3.1 connectors on the rear I/O panel, an M.2 slot that supports up to 320Mbps data rates, SATA Express support, dual Gigabit LAN controllers (Intel I218V, Realtek 8111GR), and a Realtek ALC1150 controller. The ALC1150 delivers 8-channel HD audio, Absolute Pitch 192kHz/24-bit True BD lossless sound, and supports the optical S/PDIF out port at the I/O panel.

If you're looking for a multi-GPU-capable motherboard, the SABERTOOTH X99 more than fills the bill with support for as many as four GPUs via both NVIDIA SLI and AMD CrossFire. For those running an Intel Core i7-5960X or 5930K, those 40 PCIe lanes will translate to x16/x16/x8 for three cards, and for those running the Core i7-5820K, the 28 PCIe lanes will be divided as x16/x8/x4. Note, if you want to run quad-SLI or CrossFire, you'll need to use dual-GPU graphics cards, like the Radeon R9 295X or the GeForce GTX 690.

We thought the SABERTOOTH X99 looked good on paper, but it also scored high marks in our suite of benchmarks. Highlights include the 4,853 Creative Score in PCMark, 2,693.77 pixels per second in POV-Ray, and 1,322 in Cinebench.

You have a lot of options if you're looking for an X99 motherboard, but few others have as much technology focused on keeping the board—and the rest of your components—running reliably for a

Benchmark Results	ASUS SABERTOOTH X99
3DMark Professional (Fire Strike Extreme)	7617
Graphics Score	7930
Physics Score	15975
PCMark 8	
Creative Score	4853
SiSoftware Sandra 2015	
Dhrystone AVX2 (GIPS)	285.91
Whetstone AVX (GFLOPS)	176
Multi-Media Integer AVX2 x32 (Mpixels/s)	425.15
Multi-Media Long-int AVX2 x16 (Mpixels/s)	208.87
Multi-Media Quad ALU x1 (Mpixels/s)	3.13
Integer B/F AVX/128 (GBps, mem bandwidth)	47.45
Floating B/F AVX/128 (GBps, mem bandwidth)	50.09
POV-Ray 3.7 Beta*	2693.77
Cinebench 15**	1322
Games (2,560 x 1,600)	
Metro: Last Light (16XAF)	81.4
Aliens vs. Predator (4XAA, 16XAF)	71.67
* pixels per second	
** points	

good long while. And perhaps best of all, the SABERTOOTH X99 just looks cool doing it. ■

BY ANDREW LEIBMAN

Specs: Max Memory: 64GB DDR4 (DDR4-2133; Max OC: DDR4-3333); Slots: 3 PCIe 3.0 x16, 1 PCIe 2.0 x4, 1 PCIe 2.0 x1; Storage: 8 Gbps SATA, 1 SATA Express, 1 M.2 (type 2242/2260/2280/22110); Rear I/O: 2 USB 3.1, 4 USB 3.0, 2 USB 2.0, BIOS Flashback Button & USB port, audio I/O, 1 optical S/PDIF out, 2 Ethernet; Form Factor: ATX; Warranty: 5 years

Test system specs: Processor: Intel Core i7-5960X; GPU: PNY GeForce GTX 980 Ti; Memory: 16GB Crucial Ballistix Elite DDR4-2400; Storage: 240GB OCZ Vertex 3 MAX IOPS SSD; OS: Windows 8 Enterprise (64-bit)



LEPA AquaChanger 240

Over the last few years, closed-loop liquid-cooling has exploded. Thanks to their performance, cost, and overall ease of installation, these CPU coolers have become quite popular, especially among builders making their first foray into liquid-cooling. As a result, manufacturers have flooded the market with options, hoping their “me too” offering(s) catch fire.

Instead of saying, “me too,” LEPA’s AquaChanger 240 booms, “Move aside!” LEPA has some impressive tech at work here, and the result is a closed-loop CPU cooler that stands out from a crowded field of competitors. Even the AquaChanger 240’s tubing deserves to be talked about.

We’ll start the discussion, though, with the cooler’s copper cold plate. The AquaChanger 240 uses what LEPA calls a CDP (Central Diffusing Passage) cold plate. The patented tech is an array of microfins arranged to let the coolant

surge through the base in such a way that absorbs plenty of heat from the CPU. The base itself is slightly beveled, which LEPA refers to as a “protrusive copper base.” Whatever you want to call it, the net effect is that it allows more coolant to flow through the cold plate, further increasing heat absorption.

The pair of 120mm PWM fans included with the cooler are also special. By using a dual convex blade design, these two fans are able to channel the airflow in a straight path rather than scatter it every which way. When they’re humming along at their 2,300rpm maximum rotational speed, these two blowers can produce an airflow up to 103.6cfm and a static pressure up to 4.5mm-H₂O. In short, the fans form an ideal one-two punch with the AquaChanger 240’s radiator, wicking away heat from the coolant.

As we mentioned earlier, the tubing, usually mundane enough to warrant

afterthought status, receives special attention, too. In order to maximize longevity and durability, LEPA uses a four-layer design. The outer layer is a thick, German-made tube—definitely not the flimsy stuff found on some closed-loop coolers. Working inward, you’ll find a thin mesh layer (again, of German origin), a high-density anti-leakage tube, and a DuPont nylon tube.

To test the AquaChanger 240, we saddled it to a 6-core Intel Core i7-5930K and pummeled it with a pair of CPU-intensive benchmarks. First, though, we let our system idle for 10 minutes and then took a few temperature readings. Although two of the 5930K’s cores reached maximum temps of 40 and 41 degrees Celsius, respectively, the cores consistently hovered around 26 C, with an overall average temperature of 26.8 C. Next, we ran POV-Ray’s All CPUs benchmark five times in rapid succession. Our CPU temperature peaked at 49 C, and the average temp across all cores was 42.9 C. Finally, we subjected our test system to 10 minutes of Prime95’s Small FFTs torture test. This ran the 5930K up to 59 C, with an overall average temp of 50.9 C. Apparently, all that innovation paid off.

Priced well south of \$100, the AquaChanger 240 is a great closed-loop liquid-cooler. Whether you’re interested in entering the world of watercooling, seeking a higher overclock, or both, this cooler deserves a spot on your short list. ■

BY VINCE COGLEY

AquaChanger 240

\$89.99

LEPA

www.lepatek.com

Specs: Materials: Copper (waterblock), aluminum (radiator); Socket compatibility: Intel LGA775/1150/1155/1156/1366/2011, AMD AM2/AM2+/AM3/AM3+/FM1/FM2/FM2+; Pump: 2,700rpm; Fans: 2 120mm PWM (500 to 2,300rpm); Radiator dimensions: 27 x 274 x 120mm (HxWxD)

Test system specs: CPU: Intel Core i7-5930K; Motherboard: GIGABYTE GA-X99-SLI; GPU: ZOTAC GeForce GTX 980 AMP! Extreme Edition; RAM: Crucial Ballistix Sport DDR4-2400; Storage: 240GB Intel SSD 730; OS: Windows 8.1 Enterprise (64-bit)



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Tt eSPORTS ISURUS PRO

Anyone who has spent much time playing PC games is likely very familiar with the pros and cons of big, over-the-ear gaming headsets. For top-shelf sound (and especially for directional/surround sound), full-sized headsets are hard to beat. They have massive, powerful drivers and, in some cases, comfortable padding on the ear cups, and they do a nice job of shutting down external noise and creating your own little cone of silence to game in.

On the other hand, some of them are pretty heavy and can cause a fair amount of fatigue over the course of a LAN party or a long night of gaming. Depending on the ambient temperature and how heated the competition is, a big pair of cans can also make your head unbearably hot and sweaty.

Tt eSPORTS respectfully suggests that in certain situations, maybe the answer is to ditch the cans and play wearing an in-ear headset instead.

The ISURUS PRO's 13.5mm neodymium drivers are surprisingly plucky, and they provide an almost astonishing amount of bass for in-ear headphones. We took them for a spin while gaming and then

listened to some music and a movie, and they performed admirably throughout. And although they do a decent job of quieting the noise around you, they don't drown out nearby voices completely, which is just what you want during a LAN party (for example), where you primarily want to hear your game and other players in chat, but you also want to communicate with players sitting nearby.

The headset's Secure Fit System, which consists of soft rubber spiral arms (Tt eSPORTS refers to them as "ear hooks") that help to spread contact equally across the ear, combined with the included three sizes of rubber ear sleeves, help keep things comfortable. And because they are comparatively very light, they help cut down on ear and head fatigue, and they won't leave the sides of your head soaked in sweat.

Tt eSPORTS claims the ISURUS PRO is the world's first in-ear detachable microphone headset, and while we can't corroborate that claim we can say we haven't seen one before. The upshot is that you can game with them, and then when it's time to go for a run or kick back with some music, you can simply snap the omnidirectional boom mic out of its

3.5mm socket; instantly, your gaming headset is now just a pair of headphones. What's even better is that if you're listening to your phone and you get a call after removing the boom mic, you can still take the call without unplugging, thanks to the backup mic on the inline controller. (The inline controller also lets you play or pause music and skip to the previous or next track.)

As you have also probably surmised, they are also a great deal more portable than a large headset, as they weigh next to nothing and can be wound up into a bundle that's smaller than either of the ear cups on your main headset. And because Tt eSPORTS designed them with flat, tangle-free cables, you can wind them up without worrying about spending the first hour of your LAN party trying to work out knots in the cables as a result.

If you need further evidence that the ISURUS PRO is a smarter move than a traditional headset in some cases, consider that they cost just 40 bones, which is a pittance given the comfort and functionality they will provide. ■

BY CHRIS TRUMBLE

Specs: Drivers: 13.5mm neodymium, 20Hz to 20KHz; Impedance: 16 ohm; Sensitivity: 92dB; Mic: 100Hz to 5KHz; Controller: inline mic and play/pause, previous, and next buttons; Connector: 3.5mm plug, Y adapter for detachable mic use; Extras: flat tangle-free cables, Secure Fit System, 3 sizes of silicone sleeves

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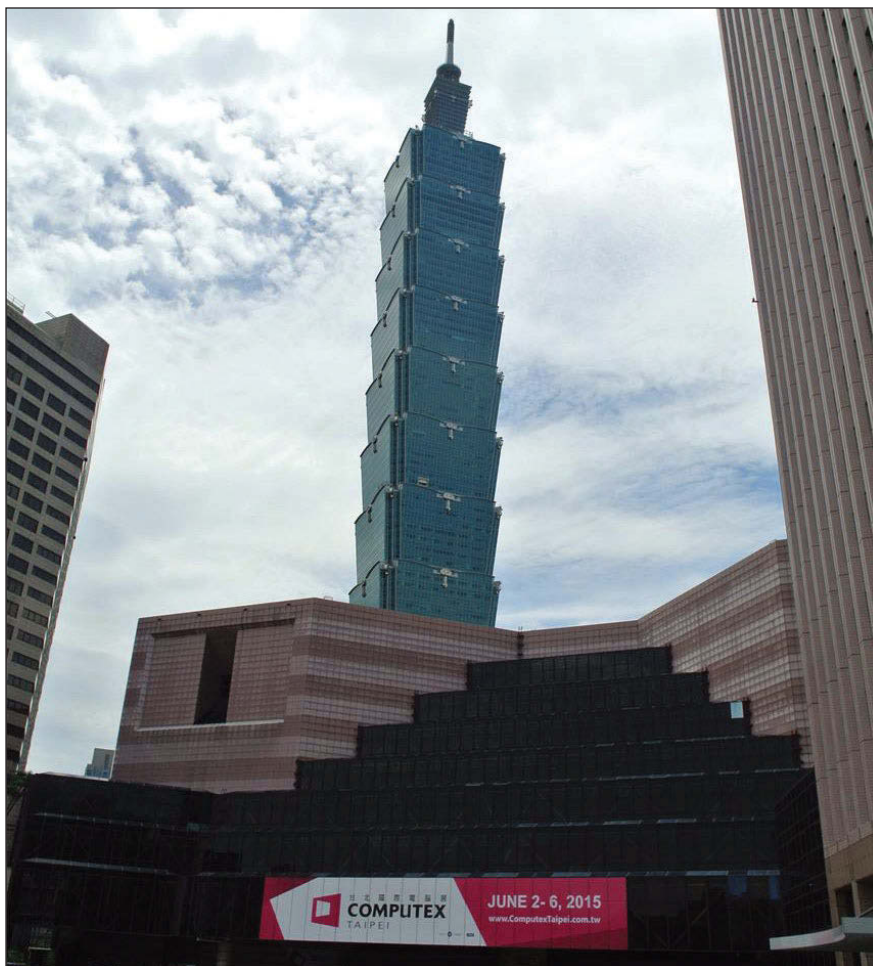
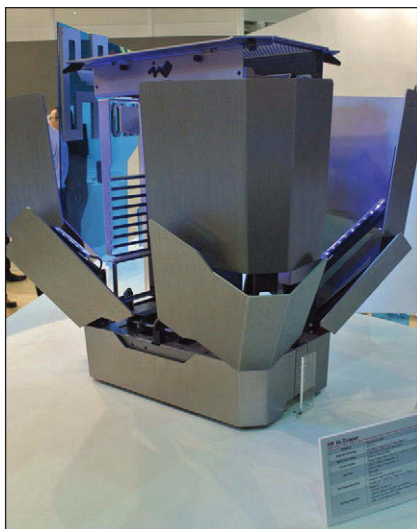
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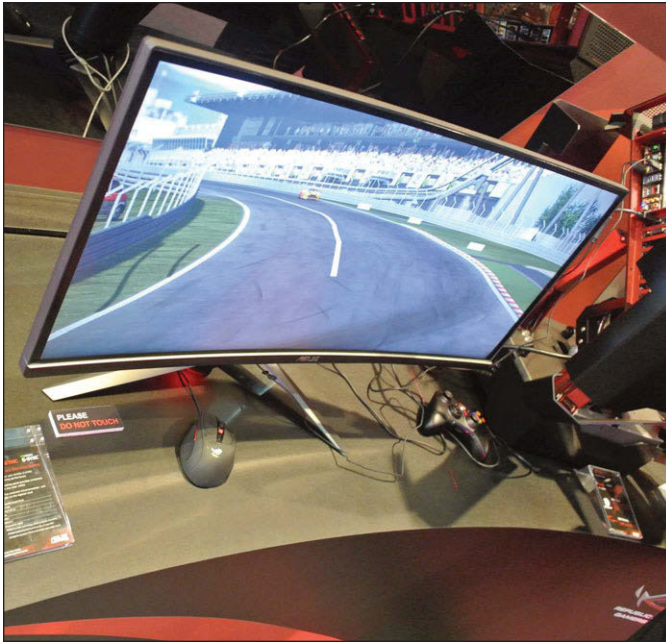
We recently travelled to Taiwan to attend COMPUTEX—the largest tech expo in Asia, and the second-largest in the world—and while there we saw variety of intriguing conceptual designs and innovations, some of which will likely be available in the near future. Best of all, there were a number of fantastic mods at some of the booths at the show, as well as some live modding demonstrations by some of our favorite modders. For example, Richard Surroz could be found at Thermaltake's booth and Lee Harrington was at Cooler Master's booth. It was great to see PC modding take a bigger stage at a worldwide event. In general, there were a multitude of Skylake motherboard mockups (none are truly finalized yet, so you won't see any particular models here) and GeForce GTX 980 Ti iterations. Read on for a recap of a few of the most truly inventive products we saw.



In Win H-Tower

In Win's cases often (refreshingly) stray from conventional case design, and the H-Tower was the talk of the show. This case literally transforms itself from closed to open. When activated, the front, side, and rear panels rotate down, while the main frame floats up and tilts for easy access to the internal hardware. The transformation can even

be remotely controlled via a smartphone app. The H-Tower is undeniably cool and quite impressive when seen in person. Unfortunately, it will be a limited release, and we're told it might be quite pricey, but as a concept case it's the innovation that truly matters. The H-Tower shows In Win's creative side, once again.



ASUS ROG Curved 34-inch G-SYNC Monitor

Slim, curved HDTVs were all the rage at CES earlier this year, and at Computex ASUS brought the same concept to a monitor that also boasts G-SYNC support. The display features a native resolution of 3,440 x 1,440 and uses an IPS (in-place switching) panel to deliver immersive gameplay. On top of all this pixel goodness, ASUS

adds lighting effects and support for its GamePlus technology.

MSI GT72 2QE Dominator Pro Tobii EyeX Edition

We detailed MSI's G72 Dominator Pro G in the June issue, and this proof-of-concept notebook adds Tobii EyeX tracking, which lets you control the PC (and play games) using just your eyes. This radically new input method takes



a little getting used to, but after a few minutes it's fairly simple to control the cursor with just your gaze. It'll be interesting to follow MSI and see if Tobii EyeX will be incorporated into future notebook lineups.

ZOTAC GTX 980 Ti Arctic Storm

Most all GPU vendors were showing off some version of NVIDIA's GeForce GTX 980 Ti, and ZOTAC's GTX 980





Ti was among the most impressive of the bunch. It features a hybrid cooling system that lets you utilize both liquid- and air-cooling. The GPU's waterblock covers most of the card, while the air-cooling dissipates any remaining heat. It comes as no surprise that ZOTAC designed this GPU for overclockers. ZOTAC also showed off a series of GTX 980 Ti AMP! Edition cards.

Thermaltake Core P5

As you've no doubt seen by our mod coverage, we believe PCs can be works of art that should be proudly displayed. Thermaltake's Core P5 case builds upon this ideal by putting your components behind a glass frame. You can opt to mount the case on a wall via its VESA mount or attach the included feet to set it on a desk.

Thermaltake used a Mini-ITX motherboard in this build but says that it should work with a standard ATX motherboard. Some nice cable routing is available, of course, because you'll want to hide any unsightly wires in your work of art. No word on when the Core P5 will be released.

AORUS X5

AORUS calls its X5 "the world's most powerful 15-inch laptop," and we'd be hard-pressed to dispute the claim. The X5 is most certainly a gaming laptop, as it comes with two GeForce GTX 965M graphics chips configured in SLI. AORUS also installs a hardware streaming engine, so you'll be able to stream games without the need to borrow graphics power from the brace of GPUs. AORUS nicely complements the streaming engine with a one-year membership for XSplit Gamecaster Premium. Amazingly, the AORUS X5 is less than an inch thick (0.9 inches, to be exact) and weighs only 5.51 pounds.

Cooler Master MasterCase

The MasterCase is all about flexibility. You can replace the panels and doors (Cooler Master showed off some tempered glass options we thought were particularly appealing), as well as the top panel—and those are just the exterior options. "Clip and click" panels on the inside let you vertically adjust or remove drive cages, ideal for altering the interior to accommodate liquid-cooling setups and extra-long graphics cards. Cooler Master tells us that even the front I/O panel can be switched out, so it's easy to update the MasterCase to whatever I/O interface is preferred in the future.

Plextor M7e

The M7e was first announced at CES, where Plextor touted performance of up to 2GBps. A firm release date still hasn't been set, but Plextor did show off some new software that adds some awesome features. PlexCompressor is a utility that automatically compresses files that haven't been accessed for 30 days. The compression is all done behind the scenes and can lead to some significant storage gains over time. Another cool tool is the PlexVault utility, which lets users create hidden partitions that anyone else using the PC couldn't view. A hotkey combination that you can custom configure grants access to the partition. ■



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A Midsummer LAN's Dream

Every LAN party is exciting, but our enthusiasm for the biggest events is nearly uncontainable. We always have a blast talking shop with our fellow nerds, and it seems like we never have to look far to take in a fiercely competitive PvP skirmish. Events like QuakeCon are especially excellent because they regularly offer gamers a first look at a bunch of upcoming AAA titles.

And of course, most of the marquee LAN parties in any given year give us an excuse to declare the *CPU System Workshop* open for business. This QuakeCon is no different, so we cleared our schedule, gathered our tools, and began our hunt for the cutting-edge components that would go into our latest build.

As usual, it didn't take us very long to scare up all the high-quality hardware we needed to put together another monster machine. In honor of all the intense competition that's sure to go down at the Hilton Anatole in Dallas, Tex. this July 23 through 26, we proudly present to you the Battle Box.

What's In The Box?

Perhaps the better question to ask is, "What's *not* in the box?" For this system, we collected a dizzying number of powerful components to assemble. The leader of the squad is a seasoned veteran and is fixing for a good fight. One of Intel's Haswell-E heroes, the Core i7-5930K is the brains behind more than a few power user PCs.

The Core i7-5930K has earned its spot in the upper ranks of elite silicon.

It's a six-core behemoth with Hyper-Threading, so it can plow through workloads 12 threads at a time. Stocked with 40 PCIe 3.0 lanes and a quad-channel memory controller that can address up to 64GB of DDR4, the Core i7-5930K is ready to make friends with multiple flagship graphics

cards and stick after stick of high-speed memory modules. The chip's multiplier is unlocked, letting you boost its 3.5GHz base clock speed with ease.

We chose GIGABYTE's GA-X99-SLI to serve as the home for our Core i7-5930K, and these digs are luxurious. True to its name, the





GA-X99-SLI supports 4-way SLI or CrossFire, thanks to its quartet of PCIe x16 slots. It also includes an M.2 PCIe connector, one SATA Express connector, support for up to 128GB of DDR4-3333, and more. As usual, GIGABYTE doesn't cut any corners with component selection. IR digital power controllers, PowIRstage ICs, black solid caps, and server-grade chokes help make the GA-X99-SLI tough as nails.

The paint has barely dried on AMD's highly anticipated R9 300 Series of graphics cards, so we had to have one for the Battle Box. Our system uses MSI's new R9 380 GAMING 2G, which comes complete with the company's Twin Frozr V cooler. The

product of 18 months of testing in the wild, the Twin Frozr V keeps GPUs cool and noise output under control. Thanks to some innovation in the Twin Frozr V's fan design, the R9 380 GAMING 2G's TORX fans kick out 19% more airflow without a corresponding increase in noise. We were excited to see what this card was capable of in our game benchmarks.

Being at the forefront of DRAM and NAND development, Crucial was the clear choice for this build's solid state drive and system memory. We loved the MX200's performance in our last build, so it's back for an encore in our QuakeCon system. For a refresher, these SSDs soar under any scenario. Boasting peak performance ratings of

555MBps/500MBps sequential reads/writes and 100,000/87,000 IOPS for random reads and writes, the MX200s let you work fast and play faster. The 500GB MX200 (2.5-inch SATA) we installed in the Battle Box has room for the operating system as well as apps galore (and games, we suppose, if you're into that).

We didn't hesitate to grab a quad-channel kit (16GB) of Crucial's Ballistix Elite DDR4-2666. This kit proves that the Ballistix line is alive and well. With the XMP profile loaded, the modules deliver 2,666MTps (megatransfers per second) with timings of 16-17-17-36. Consistent with DDR4 tech, the Ballistix Elite DDR4 kit performs like





a champ will only require 1.2V to stay fed. Tweakers will love Crucial's M.O.D. (Memory Overview Display) utility, which lets you monitor the modules' thermals in real time and log temperature data. It doesn't hurt that this kit looks sharp, too.

Wanting to take full advantage of the Core i7-5930K's unlocked multiplier, we called in a big gun—or rather, several big guns packaged and sold together. Thermalright's Pacific RL240 watercooling kit has everything you need to vanquish CPU heat. The centerpiece is the Pacific W1 waterblock; the nickel-plated copper base is polished to a mirror finish to make excellent contact with the CPU's integrated heat spreader, and the block's internal microfins let the coolant absorb lots of heat. The kit also includes a towering Pacific PT40-D5 pump-reservoir combo, which consists of a 220mm reservoir

and D5 pump, the latter of which has a variable speed controller that lets you dial back the pump pressure if desired. A thick (and we mean it; how does a thickness of 64mm strike you?) 240mm radiator packs 14 fins per inch, so it can dissipate a lot of heat from the loop's coolant in short order. A pair of Luna 12 red LED fans keep a steady supply of air moving over the radiator, and they match the red tinted coolant that Thermalright included with the kit. (The coolant is premixed, too, so we didn't have to fuss with adding distilled water.) Thermalright rounds out this kit with a fill bottle, PSU bridge tool, tubing, and chrome compression fittings to set the whole loop off.

When you replace a CPU's air cooler with a waterblock, you also have to replace the internal case airflow that the air cooler's fan(s) provided. For this task, we scooped up two Fractal Design Venturi HF-12 120mm high-flow fans,

then mounted them to our case's top panel. At full bore (1,400rpm), each Venturi delivers 83.4cfm of airflow. A low-power adapter cable is packaged with each fan, too, which slashes the fan's noise level from 25.3dBA to 19dBA, at the expense of 17.6cfm.

We didn't need these adapter cables, though, because we had Aerocool's Touch-2100 calling the shots for the Battle Box's fans. The fan controller is another one of our all-time favorites, so we had no reservations letting it occupy our case's only two 5.25-inch bays. With the ability to control the speed of up to five fans, a set of five temperature probes, and a touchscreen display that can also change colors, the Touch-2100 takes command and looks good doing it.

The Battle Box receives a steady stream of clean power courtesy of the Dark Power Pro 11 from be quiet! The Dark Power Pro 11 is be quiet!'s signature PSU, and it has the 80 PLUS Platinum certification to prove it. We chose the 850W version, which boasts four +12V rails (two 35A, two 45A) that can act as single +12V rail at the flip of a switch.

All of these exceptional components went inside Aerocool's A-1000 tower case. With the internal 2.5-inch and 3.5-inch bays removed, the case is deep enough to support graphics cards up to 16.4 inches long (or, as you'll see, a 10.55-inch long graphics card, a reservoir, a 64mm-thick radiator, and two fans). The white paint job is striking, as is the A-1000's minimalist design. It's a great box for the Battle Box's hardware.

Ready For Battle

Planning to be at this year's QuakeCon? We'll see you there. Be sure to stop by our booth for a chance to win this surly brawler of a build. ■



MSI

R9 380 GAMING 2G

We've said it before and we'll say it again, the graphics card is the most important component in a gamer's PC. For our QuakeCon Battle Box, MSI supplied one of its newly released R9 380 GAMING 2G graphics cards, which has more than enough muscle to run current generation games at 1,920 x 1,080 resolutions.

The GPU under the hood of this card is a 28nm chip comprised of a whopping 5 billion transistors. With its GCN (Graphics Core Next) 1.2-based architecture, the MSI R9 380 GAMING 2G features new 16-bit floating-point and integer instructions that enable parallel instruction processing between SIMD lanes and improved task scheduling and compute and media processing capabilities. In terms of raw horsepower, this card has 1,792 stream processors, 112 texture units, 32 ROPs, and a 256-bit memory bus connected to a 2GB DDR5 frame buffer.

MSI's card dons the firm's familiar and sharp-looking Twin Frozr V cooler, which features a red and black plastic heatsink shroud framing a pair of 90mm Torx fans. These fans alternate smooth straight blades with uniquely bulged blades, which effectively increases downward air pressure for up to 19% more airflow. A quartet of nickel-plated SuperSU Pipe heatpipes, one of which is a massive 8mm in diameter, thread the card's heatsink. MSI's Zero Frozr technology keeps the fans from spinning when the card is idle. There's a white, backlit dragon and MSI logo on the top edge of the card to give it some visibility through your case window.

Although we love the aesthetics of MSI's Twin Frozr V cooler, in order to get the towering reservoir from the Thermaltake Pacific RL 240 Water Cooling Kit just to fit



into Aerocool's case, we had to remove the right half of the MSI R9 380 GAMING 2G's heatsink shroud. The card (with shroud) measures about 10.5 inches long, but we gained roughly a quarter of an inch of clearance, which was exactly what we needed. On the bright side, the shroud came off easily with the removal of seven screws.

One of the best features of this card is its factory overclock, which MSI pumped to 1,000MHz. With the help of MSI's Gaming App, you can quickly switch between OC Mode, Gaming Mode, and Silent Mode, all at the click of a button. This is a 160-watt

card that requires two 6-pin PCIe power connectors and at least a 500-watt power supply. The back bracket accommodates dual-link DVI-I, DVI-D, HDMI, and DisplayPort outputs.

The lucky winner of our QuakeCon Battle Box will be able to enjoy some great gaming moments thanks to MSI's R9 380 GAMING 2G. ■

R9 380 GAMING 2G

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us.msi.com

SPECS

GPU: 28nm Antigua (Tonga Pro); Clocks: 970MHz/980MHz/1,000MHz core, 1,375MHz memory; Memory bus: 256-bit; Frame buffer: 2GB GDDR5; Factory overclocked: Yes; Ports: Dual-link DVI-I, DVI-D, HDMI, DisplayPort



INTEL

Core i7-5930K

There are just a few reasons an enthusiast should buy a Haswell-E processor. Granted, they're big ones. The first reason is for the memory bandwidth. Not only does the platform support the cutting edge in memory speed and latency (DDR4), but its quad-channel on-die memory controller is capable of reading and writing to the DIMMs at twice the speed of the much more common dual-channel processors. Although there are a number of things that the Intel Core i7-5930K, the middle sibling in the Haswell-E family, lacks compared to the Core i7-5960X, the memory subsystem thankfully remains intact. Intel supports DDR4-1333/1600/2133 for up to 68GBps maximum theoretical memory bandwidth. X99-based motherboards equipped with this processor will also support up to 64GB of total memory, though some models that support 16GB RDIMMs can handle even 128GB.

The Intel Core i7-5930K is a 22nm chip that is built to work in X99 chipset motherboards. This is a six-core processor with Hyper-Threading enabled, giving it the muscle to handle up to 12 concurrent threads. This, coupled with the processor's quad-channel memory controller, make it an ideal choice for enthusiasts who multitask like mad.

The core speed of this chip is set to a base clock of 3.5GHz, with a Turbo Boost clock kicking the processor up to 3.7GHz when applications need the extra horsepower. The chip also features a sizeable 15MB Intel Smart Cache shared between all cores, as well as SSE4.2, AVX 2.0, and AES instruction set extensions.

Gaming enthusiasts love the Core i7-5930K processor because it, like the Core

i7-5960X, features a full complement of 40 PCIe 3.0 lanes, which—with the right motherboard—lets users run up to four GPUs in their system, from either NVIDIA or AMD.

Other goodies under this processor's heatspreader include power-saving Idle States and Enhanced Intel SpeedStep Technology, built-in Thermal Monitoring Technologies, Identity Protection Technology, and the hybrid SSD/HDD Smart Response Technology.

Not many enthusiasts can take full advantage of a processor as powerful as the Core i7-5930K, but for those who do so on a regular basis, it's one of only two processors worth buying, and the other one costs nearly twice as much. ■



Core i7-5930K

\$594

Intel

www.intel.com

SPECS

Clock speed: 3.5GHz (base), 3.7GHz (turbo); 6 cores; Unlocked multiplier; Socket LGA2011-v3; Quad-channel memory; 15MB Intel Smart Cache; Hyper-Threading; Turbo Boost; 22nm; 140W Max TDP



GIGABYTE

GA-X99-SLI

The X99 motherboard we used for the Battle Box is none other than the GIGABYTE X99-SLI, which impressed us when we reviewed it in the June issue.

Topping our list of things to love about the X99-SLI is the board's support for 4-way SLI and CrossFire when you run it with an Intel Core i7-5960X or i7-5930K. GIGABYTE adds an onboard clock generator and a direct connection to the CPU from one of the PCIe x16 slots to dramatically increase bandwidth from 256Gbps to 320Gbps. 4-way SLI or CrossFire setups run at x8/x8/x16/x8, and 3-way setups run at x16/x16/x8.

Another feature this board supports is an all-digital CPU power design, which gives your system components consistent and clean power, so your overlocks and computing experience remain both fast and predictable. GIGABYTE relies on several high-quality components in the X99-SLI, including 10,000-hour Durable Black solid-state capacitors and server-level chokes designed to perform optimally even under the most demanding conditions. GIGABYTE also coats the CPU socket pins, DIMM slot pins, and PCIe slot pins with a thin layer of gold, to ensure maximum conductivity. If you've ever looked closely at a modern motherboard, you probably know that there's a fine art to laying out traces, and GIGABYTE adds 2 ounces of copper to the PCB to ensure those traces can handle heavy loading and dissipate heat more efficiently.

There are some advanced storage options packed into the X99-SLI, as well. SATA Express, M.2, and conventional SATA devices are all supported, with the former two at speeds up to 10Gbps, and the latter at up to 6Gbps. There are six 6Gbps SATA ports that support RAID 0, 1, 5, and RAID 10, and another four 6Gbps SATA ports are also available.



The Gigabit LAN controller comes courtesy of Intel and the audio controller is from Realtek (the ALC1150 high-definition audio codec). The audio subsystem, collectively labeled AMP-UP Audio, supports 115dB SNR playback and 104dB SNR recording. The yellow LED-backlit audio guard light path not only looks cool, but also isolates the high-end audio components from the rest of the board to help reduce the chances of audible EMI bleeding through your speakers or headphones.

This motherboard has a ton of features for gamers, overclockers, and users who're always pushing the limits of what their components can handle. It's a solid buy for any of the above, but if you stop by our booth at QuakeCon in July, you'll have a chance to walk away with this board and the Battle Box it rode in with. ■

GA-X99-SLI

\$250

GIGABYTE

www.gigabyte.us

SPECS

Max Memory: 128GB DDR4 (DDR4-2133; Max OC: DDR4-3333); Slots: 4 PCIe x16, 3 PCIe x1, 1 M.2 Wi-Fi Connector; Storage: 10 6Gbps SATA, 1 SATA Express, 1 M.2 (type 2242/2260/2280); Rear I/O: 2 PS/2, 4 USB 3.0, 4 USB 2.0, 1 optical S/PDIF out, 1 Ethernet, audio I/O; Form Factor: ATX; Warranty: 3 years



AEROCOOL

Aero-1000

To the joy of budget builders everywhere, 100 bucks actually goes pretty far these days. Want an 80 PLUS Platinum power supply? You got it! Interested in a solid-state drive bigger than 200GB? Coming right up! Can we interest you in 16 gigs of RAM?

Of course, an abundance of priced-to-move parts has a side effect also that benefits consumers: increasingly fierce competition in the value segment. Gone are the days when companies could use cut-rate pricing to cut corners on quality. Aerocool clearly understands this, because the \$99.99 Aero-1000 is a whole lot of chassis for the money.

In order to pull off such a feat, there isn't an inch of wasted space anywhere on the Aero-1000. In fact, Aerocool goes so far as to practically conjure additional internal space out of thin air. Sure, having a removable internal drive bay cage that extends the maximum allowable graphics card length from 11.4 inches to 16.4 inches is nothing new, but one thing that's particularly novel about the Aero-1000 is its recessed top panel. The space directly beneath the top panel lets you install a radiator (up to 280mm) and fans without having any of it hang over the motherboard tray. The execution is simple yet brilliant, certainly a point in the Aero-1000's favor.

Speaking of the motherboard tray, its layout covers all the bases. The cable management holes are right where they need to be, and the important ones are lined with rubber grommets. A notch in the top-left corner of the motherboard tray provides plenty of room to run your PSU's

8-pin CPU power cable. The CPU cooler cutout is ample, just like we like it. Rounding out the Aero-1000's roster of helpful features are easily removable dust filters, a set of skid-proof case feet, and vibration-dampening rubber PSU pads.

We haven't even touched on the exterior. Aerocool has long had a reputation for designing eye-catching cases, and in that regard, the Aero-1000 is no different than any of the company's other offerings. What is different is the way Aerocool pulls it off. Instead of orchestrating a harmony of LED lights and aggressive aesthetics, Aerocool holds back, and the result is the wonderfully restrained Aero-1000. Visually, the case is clean and cool, and our White Edition variant is especially striking. Traditionalists will be pleased to know the Aero-1000 comes in black, too.

Thanks to all of the Aero-1000's builder-friendly features, assembling the Battle Box was a straightforward affair. If



you're looking for a solid, attractive case at a price that won't shred your budget, this chassis won't let you down. ■

Aero-1000

\$99.99

Aerocool

www.aerocool.us

SPECS

Dimensions: 19.7 x 8.3 x 19.4 inches (HxWxD); Materials: 0.8mm steel, plastic; Motherboard support: Mini-ITX, microATX, ATX; Drive bays: 2 x 5.25-inch external, 2 x 2.5-inch internal, 5 x 2.5/3.5-inch internal; Fans (included): 2 x 120mm front, 1 x 120mm rear; Fans (optional): 2 x 140mm front, 2 x 120mm or 2 x 140mm top; Ports: 2 x USB 3.0, audio I/O


CRUCIAL

MX200 500GB

In 2015, what does a solid-state drive need to do? No, seriously, SSDs have matured to the point that they can fill almost any need. For the speed freaks, PCIe SSDs are only getting faster, and for budget builders, \$75 to \$100 buys you a lot more drive than it used to. Laptop, netbook, and nettop owners can find small form factor SSDs that are nearly as fast as their desktop counterparts.

If niche products occupy one end of the spectrum, Crucial's 500GB MX200 occupies the other. In other words, it's a well-balanced drive capable of performing a variety of roles. It's fast, it's big, and it sells online at a price that won't shock your wallet. These are three very good reasons we chose it to be the Battle Box's storage drive.

Would you like more reasons than that? Very well—we'll start with Crucial's custom firmware. As a major manufacturer of NAND Flash, Crucial knows a thing or two about optimizing its NAND for exceptional performance. By working closely with Marvell, which produces the storage controller found in the MX200 (model 88SS9189), Crucial is able to have the MX200 drives' NAND, controller, and firmware working together hand in hand. This kind of expertise isn't something you'll find on a spec sheet.

In addition to its custom firmware, Crucial also loads the MX200 with several other technologies that help distinguish these drives from the competition. In order to keep data stored on the drive safe and sound, there's RAIN (Redundant Array of Independent NAND, which behaves similarly to a RAID at the drive level) and four layers of Executive Data Defense. Extreme Energy Efficiency may not provide



a tremendous benefit when the drive is installed in a desktop PC, but for laptop owners swapping out their tired old HDD, the technology is a godsend. According to Crucial, Extreme Energy Efficiency makes the MX200 over twice as energy efficient as a typical hard drive; you'll be able to work faster and longer.

The MX200 we installed in our build is a 2.5-inch (7mm high) form factor drive, clearly the most common type of SSD, but Crucial has populated the MX200 line with a bunch of different-sized SSDs. Remember what we

said earlier about SSDs filling a number of roles? With mSATA and M.2 form factor drives, you can install an MX200 in virtually any system. And the best part: Performance is the same regardless of form factor.

That performance is, as we expected, terrific. You can check out our benchmark results in our summary article, but for now we'll say that the MX200's bang for your buck is loud to the point of deafening. ■

MX200 500GB

 \$209.99 | Crucial | www.crucial.com

SPECS

Interface: 6Gbps SATA; Controller: Marvell 88SS9189; Maximum sequential read/write: 555MBps/500MBps; Random read: 100,000 IOPS (QD 32); Random write: 87,000 IOPS (QD 32); Form factor: 2.5-inch; Warranty: 3 years


THERMALTAKE

Pacific RL240 Water Cooling Kit

At some point, most power users have at least entertained the idea of converting to liquid-cooling. On one end of the spectrum is the all-in-one route, which isn't terribly different from (and in some instances, easier than) installing an aftermarket air cooler. On the other end, you can create a completely customized setup, but then it's up to you to do all the research, choose the right components, and hope everything works together.

There is a middle ground: a prepackaged kit. The parts are all picked out for you. Instead of filling up your shopping cart with item after item, everything you need comes in one box. Pop that box open, connect all the pieces, fill the whole thing up with coolant, and you're off to the races. With its Pacific RL240 Water Cooling Kit, Thermaltake is staking its claim to this territory.

The foundation of the Pacific RL240 kit is the Pacific W1 waterblock. The copper base is nickel-coated to prevent corrosion, and a mirror finish ensures the best possible heat transfer from the CPU. It's an effective approach, sure, but the block's real muscles are hiding inside: An array of 0.15mm microchannel fins provide a tremendous amount of surface area to soak up heat, and a silicone rod guides the coolant through these channels.

The next stop on our journey is the Pacific PT40-D5 pump-reservoir combo unit. The reservoir holds an impressive 400ml, and the pump, a D5 unit as its name suggests, is no slouch. With a maximum flow rate of 1,135L/h and a maximum head of 15 feet, the PT40-D5 keeps the coolant churning. There are five speed settings for



Pacific RL240 Water Cooling Kit | \$299.99 | Thermaltake | www.thermaltakeusa.com

the pump motor, too, going from 1,800 to 4,800rpm in 750rpm increments. The kit includes the necessary mounting brackets for a vertical or horizontal orientation.

The last major component included in the Pacific Series RL240 KIT is anything but the least. The Pacific RL240 radiator isn't any old chunk of machined aluminum. Densely packed fins (14 per inch) and an infusion of zinc (for its anti-corrosive properties) increase the radiator's cooling performance and life span, respectively. The real secret sauce, though, is Thermaltake's brazing process. By blasting the radiator with

1,000-degree heat, Thermaltake literally melts the RL240's fins to the cooling tubes, which results in better heat transfer than traditional soldering methods.

In this kit, a wonderful supporting cast complements the three leads. You get two Luna 12 red LED 120mm fans, six chromed compression fittings, 1,000ml of coolant, a fill bottle, plenty of tubing, universal mounting brackets for Intel and AMD sockets, a syringe of thermal paste, and even a 24-pin ATX PSU bridge. Custom liquid-cooling can be daunting to beginners, but it doesn't get any easier than this. ■

SPECS

Waterblock: Copper base, G1/4 threads, Intel LGA775/1150/1155/1156/1366/2011 compatible, AMD AM2/AM2+/AM3/AM3+/FM1/FM2 compatible; Reservoir/pump combo: 400ml capacity, 1,135L/h max pump flow rate, 50psi max pump pressure, 4,800rpm max pump speed; Radiator: 2.5 x 5.1 x 11.1 inches (HxWxL), aluminum; Fittings: Chrome finish, 1/2-inch inside diameter, 3/4-inch outside diameter; Fans: 120mm, 1,200rpm, 50.44cfm, 20.7dBA, 1.32mm-H₂O


CRUCIAL

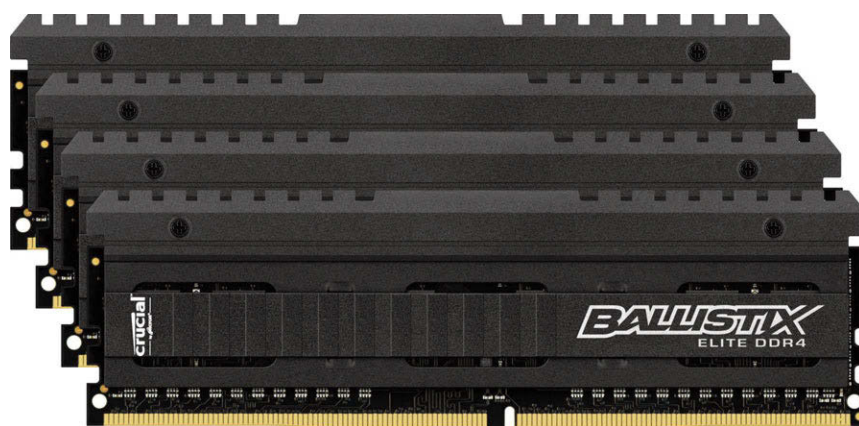
Ballistix Elite DDR4-2666 16GB

Our QuakeCon build's Core i7-5930K and X99 motherboard preclude the use of any memory but DDR4, but that suits us just fine. After all, DDR4 is the pinnacle of system memory technology. It allows for higher module density and runs at higher speeds than DDR3, and it does so while running at lower voltages. Win, win, and win.

When it came time to select system memory, we went to the experts at Crucial and asked for a kit that was very fast and very dependable, and that would look at home in a case packed with cutting-edge parts. Crucial sent us its Ballistix Elite DDR4-2666 16GB kit, with four 4GB modules to keep our quad-channel beast fed and Intel XMP support that makes it easy to push speeds up to 2,666MTps (megatransfers per second).

We put the kit to the test prior to installing it in our QuakeCon rig and found it to be more than satisfactory. SiSoftware Sandra's Cache & Memory Latency test reported that the 2,666MTps kit hit its target speeds with latency rates of just 31.3ns; it did this with tight timings (16-17-17-36) and while running at a mere 1.2 volts.

If you enjoy keeping an eye on system temps and maintaining tight control, you'll love this kit, because not only is it an absolute beast, but it also supports Crucial's Ballistix M.O.D. (Memory Overview Display) utility and comes with a thermal



sensor already embedded in each module, so you don't have to mess around with taped-on temp sensors. Download and install the small utility (the zipped download is just over 1MB in size; you can grab it at www.crucial.com/usa/en/memory-ballistix-mod-utility) and you will have real-time, at-a-glance access to your memory's temperature information. In addition, you can have the program log your kit's temps over time so that you can correlate spikes with specific applications and even set temperature alerts. When it comes to effective overclocking, knowing really is half the battle, and with M.O.D. in place you'll never have to guess what's going on with your memory.

Oh, and you may recall that we told Crucial we wanted a kit that looked the part . . . this one does. Its black heat spreaders look great from every angle, and because they are all black with just a little bit of white (the Ballistix logo printed across the middle of the spine and along the side on one end of each module), they are an easy fit with a wide range of color schemes. As you'll see in the shots of our finished system, they are right at home in its black-and-red interior. ■

Ballistix Elite DDR4-2666 16GB

\$255.99

Crucial

www.crucial.com

SPECS

Capacity: 16GB (4 x 4GB); Timings: 16-17-17-36; Frequency: DDR4-2666; Voltage: 1.2V; Unbuffered; Non-ECC; Warranty: limited lifetime



BE QUIET!

Dark Power Pro 11 850W

We've reviewed power supplies from German manufacturer be quiet! in the past, and in our experience they are outstanding. They provide clean, efficient power and do so while living up to their name (they remain very quiet) and looking great. In addition, the company consistently outfits its PSUs with an impressive selection of cabling options, including CPU power cables that are extra long so that you can reach the CPU power socket from a bottom PSU bay comfortably and still keep everything tucked neatly out of sight. In short, there's not much more that you could ask from a power supply.

That's why it made sense to us to look to be quiet! for a PSU for our QuakeCon build, and the company responded by sending us its Dark Power Pro 11 850W. This is a semi-modular unit with 80 PLUS Platinum certification that be quiet! characterizes as the most technically advanced power supply it has ever built.

The Dark Power Pro 11 850W supports NVIDIA SLI and AMD CrossFire multi-GPU configurations and runs at up to 94% efficiency. It is equipped with a 135mm SilentWings 3 fan that has fluid dynamic bearing construction and a six-pole motor, so it runs quietly and should do so for a very long time. You can install the Dark Power Pro 11 with its fan facing up or down, and because be quiet! knows that you care about how the inside of your PC looks, it orients the labels on the side of the PSU so that yours will face right-side-up no matter which way you choose to mount the unit.

Speaking of flexibility, the Dark Power Pro 11 850W comes with an overclocking key that lets you choose between the unit's standard multi-rail operating mode, which utilizes four independent 12V rails, and high-performance single-rail operation. The



OC key in essence connects the unit's 12V rails to allow for full-power output via one rail, which makes sense in some cases where users are overclocking multiple components and pushing their systems' power draw fairly close to the PSU's maximum.

The semi-modular Dark Power Pro 11 comes with only a single cable permanently attached—the 20+4-pin main ATX power cable. This makes sense because no matter what else you may or may not be installing in your system, you will absolutely need the ATX power cable. Everything else is optional, and options are plentiful. be quiet! ships the unit with two CPU power cables (one 8-pin and one 4+4-pin), a single PCIe 6-pin cable, six PCIe 6+2-pin connectors,

seven 4-pin Molex hard drive connectors, eight SATA connectors, an FDD connector, a 4-pin motherboard connector, and four external fan cables.

The be quiet! Dark Power Pro 11 850W was a great addition to this build. It installed easily, performed admirably and incredibly quietly, and allowed us to only use the cables we needed to power our installed components. It may not be the most expensive part in our PC, but it very well may be the best. ■

Dark Power Pro 11 850W

\$199

be quiet!

www.bequiet.com

SPECS

Maximum wattage (continuous): 850W at 40 C; 12V rails: 4 (130A); +5V max: 25A; +3.3V max: 25A; Efficiency rating (advertised): 94%; Fan 135mm; Connectors: 1 x 20+4-pin ATX, 1 x 8-pin EPS12V, 1 x 4+4-pin ATX/EPS12V, 1 x 6-pin PCIe, 6 x 6+2-pin PCIe, 8 x SATA, 7 x Molex, 1 x floppy; Warranty: 5 years



Our QuakeCon Build Delivers Seismic Results

This time, the *CPU System Workshop* stayed open after hours to bring the Battle Box to life. Despite manufacturers' best efforts, not every build can be a tool-less build. Sometimes, tools are required. Lots of tools.

A slight exaggeration, to be sure, but assembling this system required a little creativity in order to install every component. When you're working with a mountain of top-shelf hardware, even the most well-designed cases can burst at the seams. This was what happened with our Aerocool A-1000, which really is a very accommodating case. However, Thermaltake's Pacific RL240 liquid-cooling kit happens to be impressively massive (also a good thing). Installing the entire kit, especially the Pacific RL240 radiator and Pacific PT40-D5 pump-reservoir combo, was a challenge, but that's what we live for.

The cost of using these incredible liquid-cooling components was the A-1000's 2.5-inch and 3.5-inch drive bays, plus a portion of our MSI graphics card's cooler shroud. Removing the internal drive bays dispossessed our Crucial SSD, but we were able to mount it on the back side of the A-1000's 5.25-inch bay. These were a noble sacrifices all around, but we like the end result.

The end result, in this case, was a custom liquid-cooling system that let us punch in a stout CPU overclock. By setting the Vcore to 1.3V, we were able



jack up the Battle Box's Core i7-5930K's multiplier to 45, good for a core clock of 4.5GHz. We're always tempted to aim higher, especially with this system's cooling setup, but we also want to bestow this sweet system to one lucky QuakeCon attendee, and we'd rather give away a

fully functional PC instead of a charred husk. CPU core temps under load stayed between 60 and 70 degrees Celsius, well below the 5930K's TJmax, which suggest that there's leftover headroom for even more overclocking adventures. We'll leave that to the winner.

SPECS

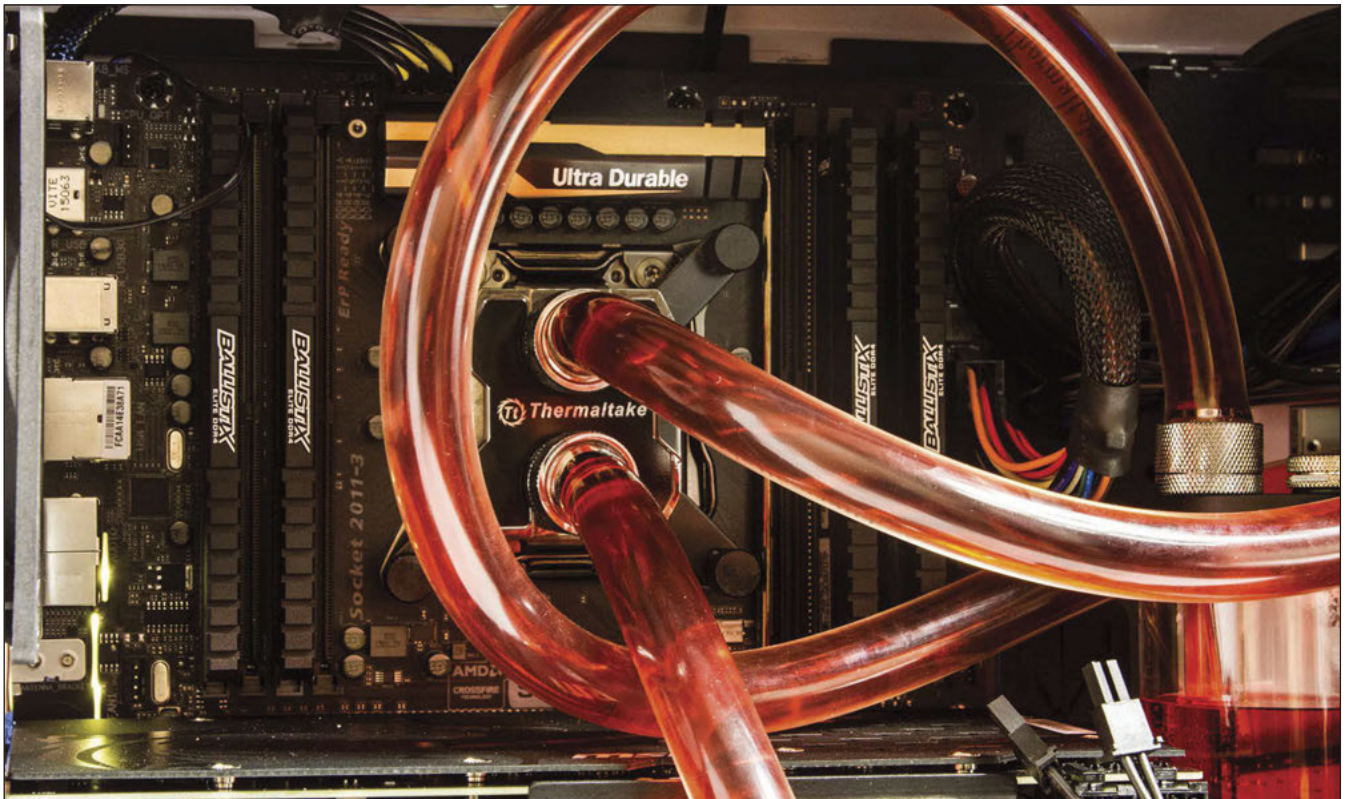
Processor: Intel Core i7-5930K; Motherboard: GIGABYTE GA-X99-SLI; Graphics card: MSI R9 380 GAMING 2G; RAM: 16GB Crucial Ballistix Elite DDR4-2666; Storage: 500GB Crucial MX200; PSU: be quiet! Dark Power Pro 11; CPU cooler: Thermaltake Pacific RL240 Water Cooling Kit; Case: Aerocool A-1000; Additional case fans: 2x Fractal Design Venturi HF-12; Fan controller: Aerocool Touch 2100; Windows 8.1 Pro



And besides, at 4.5GHz, the Battle Box did a lot of damage in our CPU-intensive benchmarks. It produced big gains in both Cinebench (19% improvement) and POV-Ray (24%), as well as most of our Sandra 2015 benchmarks.

At 1080p, the MSI R9 380 GAMING 2G delivered satisfying results. It averaged better than 50fps even in the punishing Witcher 3: Wild Hunt. The brand-new graphics card certainly has the chops to take on any game you throw at it.

All told, the Battle Box produced very satisfying results in all of our benchmarks. It's an incredibly well-rounded, not to mention good-looking system. Not bad for giving up a few drive bays. ■





Benchmark Results	Battle Box (stock)	Battle Box (4.5GHz)
3DMark Fire Strike	3707	3730
Graphics Score	3808	3802
Physics Score	14264	17601
PCMark 8		
Creative Score	4661	5035
Cinebench 15	1079	1283
POV-Ray 3.7 Beta (pixels per second)	2216.9	2748.13
SiSoftware Sandra 2015 Lite SP2		
Dhrystone AVX2 (GIPS)	235.88	291.79
Whetstone AVX (GFLOPS)	149	180.5
Multi-Media Integer x32 AVX2 (Mpixels per second)	371.76	429
Multi-Media Long-int x16 AVX2 (Mpixels per second)	175.72	219
Multi-Media Quad-int x1 ALU (Mpixels per second)	2.76	3.45
Multi-Media Single-float x16 FMA	369.46	417.1
Integer Memory Bandwidth B/F AVX/128 (GBps)	42.6	43.37
Floating Memory Bandwidth B/F AVX/128 (GBps)	43.81	44.31
CrystalDiskMark 3.0.1 (MBps)		
Sequential Read	492.7	485.5
Sequential Write	476.4	473.1
512KB Random Read	431	422.8
512KB Random Write	457.9	450.2
4KB Random Read QD1	25.45	26.32
4KB Random Write QD1	87.02	85.28
4KB Random Read QD32	316.7	315.4
4KB Random Write QD32	344.2	340.2
Games (1,920 x 1,080)		
Aliens vs. Predator (Very High, High Shadows, SSAO, 4XAA, 16XAF)	61.1fps	61.2fps
Metro: Last Light (DX11, Very High, 16XAF, Very High Tessellation)	53.67	54
Dying Light (Med, AO On, AA On, Vsync Off)	66.34	65.89
Witcher 3: Wild Hunt (Vsync Off, Unl. fps, Ultra)	50.72	52.43

HARD HAT AREA
PC MODDER
MAD READER MOD



Ramiel

About five years ago, Josh “NFC” Sniffen (“NFC” stands for “Not From Concentrate”) won our Mad Reader Mod prize with his Seraphim mod, a gorgeous small form factor mod with immaculate custom angel-themed graphics on the outside and an interior that was just as impressive.

Although this month’s Mad Reader Mod is equally (or perhaps more) impressive, the only other thing it has in common with Seraphim is its name: Ramiel.

“I named my first mod after a Hebrew angel because the name and meaning sounded pretty cool,” Sniffen says. “I continued on with this tradition. Râmîêl roughly means ‘Thunder of God,’ but the name has no connection with the mod’s theme.”

F.L.W.

At a glance it’s easy to see that Ramiel is not like other PC mods, and as it happens, that’s the point.

“The most important goal for this project was to come up with a totally unique arrangement of parts where the key components were emphasized and isolated,” Sniffen says. “I augmented that goal with trying to blend four materials and ‘essences’ together: wood, metal, glass, and circuitry. The idea was a progression of the raw materials to the man-made.”

Sniffen’s inspiration for the mod comes not from the world of computing, but from the world of architecture: “I love architecture and perusing coffee-table books on the subject from the masters,” Sniffen says. “Frank Lloyd Wright can never be overrated, and I love how he blended materials in unique ways and managed to tie them into their surroundings.”

Modder At Work

Sniffen says Ramiel came together in a relatively short period of time: “This mod is unique in that it was built in two weeks—that includes the sourcing of materials and the polishing of the design (I had a rough concept in my head),” Sniffen says.

Sniffen, who does the bulk of his fabrication work in his garage/shop, says that the most unique material he used in building Ramiel was the inclusion of purpleheart wood, which comes from Central and South America.

“I went into this project never having worked with wood, and I picked a challenging one to start with,” Sniffen says. “It

is brutally hard, almost like a ceramic, and it chewed through my cobalt drills and specialty saw blades.”

On the other hand, purpleheart wood’s unique color properties made one part of the process easier: “It was incredible to not need any stain and still get a rich, purple-red color that will deepen with age.”

Sniffen says Ramiel turned out even better than he had hoped: “I make more than my fair share of mistakes, but I am actually much happier with the final product than I am with the original design . . . for once,” he says. “The most notable changes were the iron-wrought powder coat on the aluminum; I originally intended the aluminum to be bare and anodized, but the colors and texture of the powder coat ties into the wood much better.

“The second major change involved beveling the wood. This was a last-minute change that added tremendous complication to the project but I also feel that it was a key element to the design and I would not have been happy with the finished project had I not taken the time to make the change. I did have to worry about plunge depth for the bolt sleeves and figure out how to get the radius curve over the irregular geometry of the board. I ended up using a hobbyist CNC to get the taper started, which meant I had to learn the program and convert my drawing to G-code [a programming language for machine tools], which was new to me. From there, I finished it off through sanding and filing.”

As you can probably tell, Sniffen built Ramiel’s entire structure from scratch. He cut the metal portion from large sheets of 6061T aluminum plate a little over three sixteenths of an inch thick. The glass is 1-inch optical-grade cell-cast acrylic. Sniffen cut all of these parts with a high-pressure water and garnet abrasive cutter, hand-finished them, and bolted them together with stainless-steel hardware for easy disassembly.

When it came time to cable the system, Sniffen cut his own cables by hand.

“I’m really terrible with sleeving, and I had very little space to work with, but the decision to pre-cut and bend all the wires individually worked out and I think it looks OK,” Sniffen says, noting, “I replaced all of the Molex connectors with black ones, but I left the blue Molex connector on the PSU blue. It is ugly and sticks out like a sore thumb. I originally wanted it to be a reminder that the PSU was not supposed to look integrated or organic like the rest of the

mod, and wanted to use it to separate it from the rest of the build—not necessarily in terms of color, but in actual ‘essence’: manufactured plastic. I’m not sure I succeeded in that idea, but it does start conversations.”

Sniffen bent perforated PCIe dust covers into rings for managing his cables, built backplates and shields for his electronic components, and painted his PSU and changed out its fan parts.

The World According To Josh

In the case of Ramiel, at least, form definitely seems to trump function in Sniffen’s mind. When asked about the components in his build, he was uncharacteristically vague, pointing out that the build supports three SAPPHIRE Tri-X R9 290X graphics cards, as well as “an SSD, a motherboard, and even some RAM!”

Sniffen says he has already begun work on his next mod: “My dream since 2009 has been to perfect the console PC (the new popular title is Steam Box), and I plan on taking my production-ready prototype to PDXLAN in July.”

Given Sniffen’s goal of using new materials and learning a new skill with every project (you can see more of his amazing work at www.nfc-systems.com), we’re looking forward to seeing what his take on Steam Machines will look like.

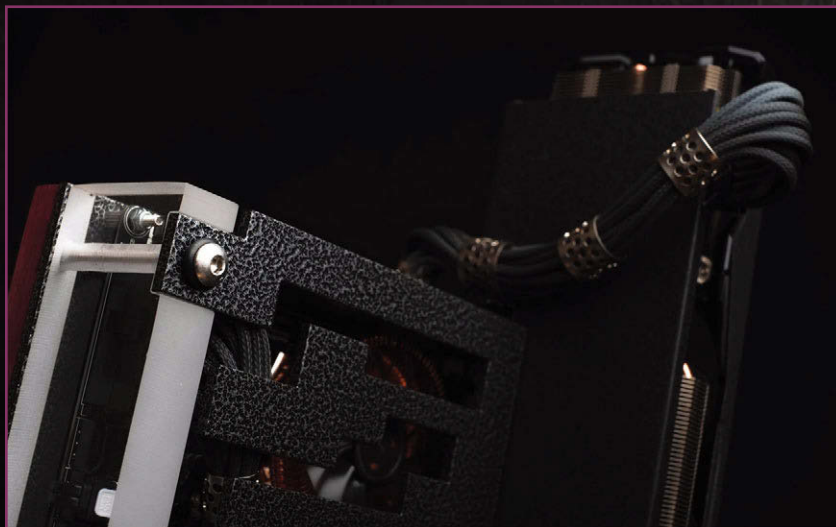
“My mods tend to be pretty polarizing and attract few fans, but I hope that at least they are unique and that I can share some wild ideas with the excellent modding community,” Sniffen says. ■

We Want Your Mod

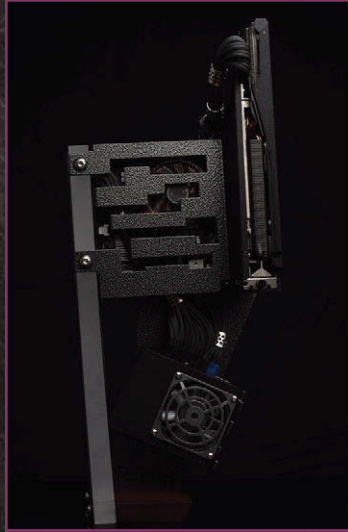
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Deepcool Tristellar

Set Jaw To Drop

Computer cases are supposed to be big metal boxes. We've practically had this belief hard-coded into our DNA. So, when a case comes along that defies this notion, we take notice. Whether we see them at an expo or a LAN party, cases with unique designs are seared into our brains.

Prepare your prefrontal cortex, because Deepcool has a new case that will permanently etch itself into your memory. The Tristellar is the first of the company's cases to take conventional chassis design and throw it out of the window, into the stratosphere, and on to the next galaxy. In fact, the only aspect of the Tristellar that might rival its stunning aesthetics is the sheer amount of hardware it can hold. From front to back, there are accommodations for a raft of enthusiast-caliber components.

The Tristellar is unlike any other case we've seen, and that's quite an achievement. This month, we're performing extensive reconnaissance and exposing all the skunkworks within. Let's find out what happens when Deepcool puts the traditional case blueprint in the shredder.

Deepcool R & D

As you might guess, a case as innovative as the Tristellar doesn't come together overnight. According to Lei Liu, product director at Deepcool, the design team turned to one of sci-fi's most cherished franchises for inspiration.

"Our goal was to create a PC chassis that is 'outside the box,'" Liu says. "The original design is based on 'Star Wars,' and of course, we wanted to make it stellar."

With its objective established, Deepcool embarked on an adventure that would last nearly an entire year. The company solicited the opinions of its customers, as well as other PC enthusiasts, gamers, and consumers to find out what makes a truly exciting case. "We learned that people want

a unique, creative design and excellent cooling performance, rather than a box."

Easier said than done, as Deepcool's engineers found out. Liu says that the most daunting task was taking the Tristellar's original design and appearance and making it a functional PC chassis. Over the course of the year, the design team constantly tested and upgraded the case in order to make room for more components, increase the case's cooling capabilities, and arrange the internal layout to simplify hardware installation.

As far as a creative, original design goes, you can see the results for yourself. That said, the Tristellar is more than just a pretty face. Pull off the individual compartment shrouds and you'll see that it has plenty of smarts, too.

Cabin Fever

The Tristellar's claim to fame is its system of independent component compartments,

which Deepcool calls cabins. Each cabin is connected to a central "spine" that runs the length of the chassis. Thanks to the Tristellar's steel construction, the whole case feels remarkably sturdy, despite the fact that the "case" is essentially a trio of chambers linked together.

There's a practical benefit to this structure. By using what Liu calls an "individual air duct system," the Tristellar is able to isolate the hottest components into separate compartments. "Most of the chassis now available only have a whole air duct system," Liu says. "The individual ones we designed provide better cooling performance for the whole build."

The top compartment can house some very big guns. First and foremost is a cutting-edge flagship graphics card, because the Tristellar provides enough room to install a single card up 12.5



Unveiled in January at CES, Deepcool's Tristellar case is undeniably unique.

inches long. Whether you choose AMD or NVIDIA silicon, you should have all the room you need to fit it into the case's top compartment. And with three expansion slots to mount the card, the Tristellar is compatible with an aftermarket card fitted with a massive, three-slot GPU cooler. In order to deliver extra cooling to the graphics card, Deepcool preinstalls a 90mm case fan at the front of the chamber.

In the graphics card compartment, we also get our first taste of Deepcool's design genius. The PCIe x16 slot connects to a riser card and cable combination that snakes through the chassis to the lower right compartment, where the opposite end connects to your motherboard's PCIe x16 slot. In doing so, Deepcool is able to separate the graphics card and motherboard in their own compartments.

After you install the graphics card, you can give it a few roommates, because the top cabin also houses three 2.5-inch drive bays. All of the bays support hot-swapping, too, so you can pop SSDs in and out, if desired. With the combination of a high-end graphics card and a series of lightning-fast SSDs, the top compartment is capable of holding a lot of firepower.

The lower right compartment is where the motherboard tray resides, as we've suggested. The Tristellar's requires a Mini-ITX board, but you can build a surprisingly potent system around this form factor. Based on the dimensions of the chamber, the Tristellar's CPU height limit is 3.3 inches, which should be enough clearance for a low-profile CPU cooler or a closed-loop liquid-cooler's pump-waterblock unit.

Now, a closed-loop liquid-cooler naturally has a radiator, and that radiator has to go somewhere. In addition to the motherboard tray, the Tristellar's lower right chamber also has a 120mm fan mount, which also includes room for a 120mm radiator.

Moving to the final cabin, you'll find space for the power supply and even more drive bays. Starting at the back, the PSU bay supports standard ATX power supplies up to 6.3 inches long. In truth, there's about 8 inches between the back of the compartment and the internal 3.5-inch

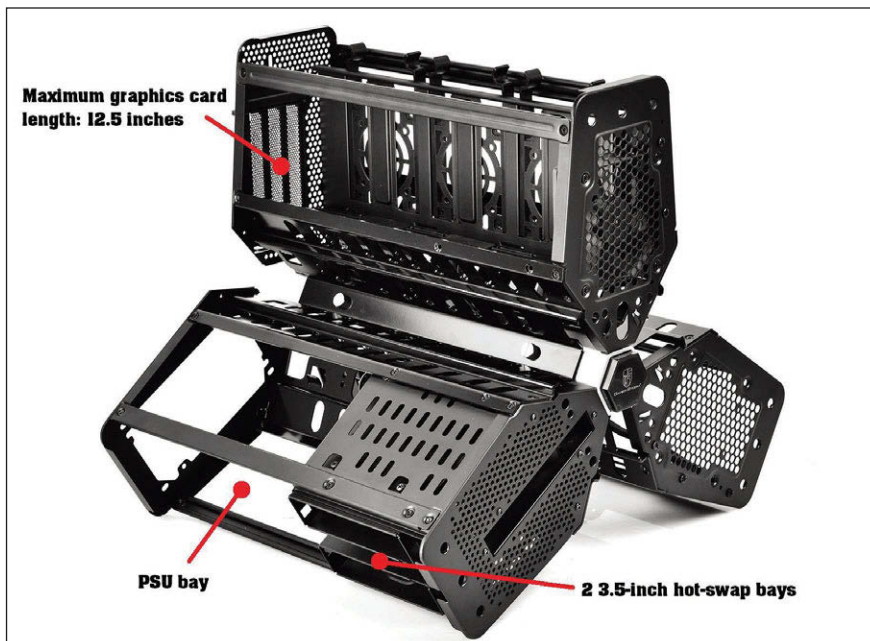
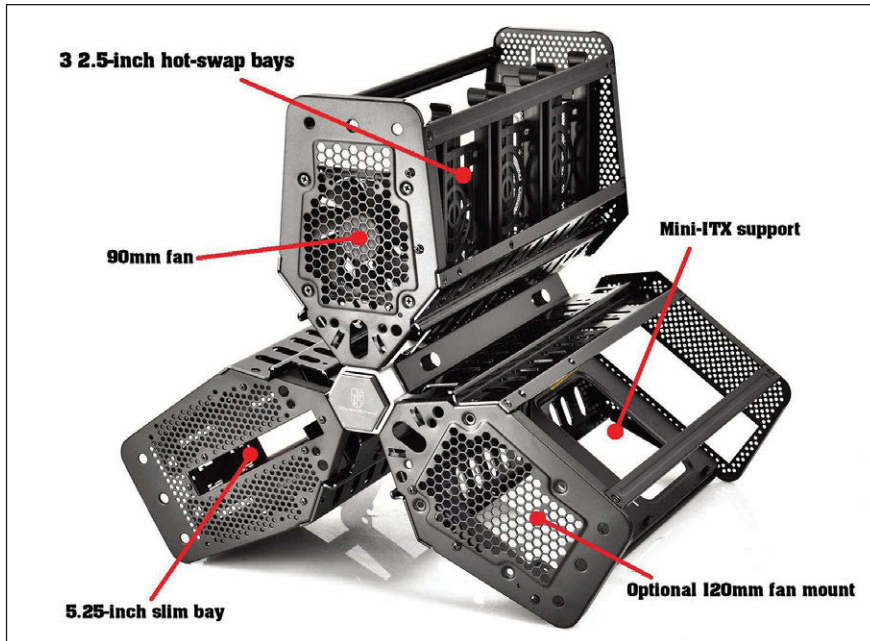
Bill Owen's Tristellar Mod

What do you get when you give a truly unique PC case to one of the most distinguished modders in the known universe? Duh—the breathtaking mod that's pictured below. The product of Bill Owen, the mad genius whose work you last saw in *CPU* a mere eight months ago (Owen's "Biomechanical" mod, a tribute to the late H.R. Giger, was our November 2014 Mad Reader Mod), this mod has a striking paint job, custom air ducts, and case windows that show off the mod's EVGA GeForce GTX 980 Superclocked and three 256GB Crucial MX100 SSDs.

In addition to the graphics card and SSDs, the system has some equally impressive hardware under its three hoods. There's a Deepcool DA700 PSU, Deepcool Maelstrom closed-loop liquid-cooler, an Intel Core i7-4790, ASUS's Z97I-PLUS motherboard, 8GB of AVEXIR Blitz 1.1 Series Original DDR3-2400.

The finished product knocked Deepcool's socks off. The company was so impressed with Owen's work that a special limited edition Tristellar based on his mod is being prepped. Look for it this fall.





DEEPCOOL TRISTELLAR VITALS

Specifications	
Dimensions	15.3 x 17.1 x 15.6 inches (HxWxD)
Weight	35.3lbs.
Material	SPCC steel
Bays	1 5.25-inch slim 2 3.5-inch hot-swap 3 2.5-inch hot-swap
Fan (included)	1 90mm (VGA cabin)
Fan (optional)	1 120mm (motherboard cabin)
PSU support	ATX (6.3-inch length limit)
CPU cooler height limit	3.3 inches
GPU length limit	12.5 inches
Front panel	2 USB 3.0, audio I/O

possible. The Tristellar has enough room to hold a lot of components, but internal space is still a premium.

Because Deepcool recognizes that lots of users still have 3.5-inch hard drives, and some still rely on the services of an optical drive, the rest of the Tristellar's lower left cabin consists of bays for these components. You can install a pair of 3.5-inch HDDs, and like the Tristellar's 2.5-inch drive bays, these two bays are also hot-swappable. The external 5.25-inch bay requires a slim optical drive.

Beautifully Bold

So much of the power user lifestyle is about making a statement, and one of the easiest ways to do that is with an eye-catching build. Deepcool's Tristellar case basically takes care of that for you right out of the box, with a one-of-a-kind look that doesn't force you to make very many compromises with the rest of your hardware. That sounds . . . what's the word? Right—stellar. ■

Pull off the Tristellar's three compartment (which Deepcool calls cabins) covers to reveal all the goodness inside. In total, the Tristellar can contain up to five storage drives, a full-sized ATX power supply up to 6.3 inches long, one graphics card up to 12.5 inches long, and a closed-loop liquid-cooler with a 120mm radiator.

drive bays, but the 6.3-inch limit that Deepcool imposes is very sensible, since it takes the power supply's cable bend into account. Based on our hands-on with the case, we think Deepcool may be slightly on

the conservative side; we suspect PSUs up to 7 inches long will fit inside the Tristellar. Regardless of the PSU's length, we highly recommend using a modular unit in order to make cable management as easy as

ASUS MG279Q

The Monitor Your Eyes Want Is The Monitor They Deserve



Ever been at a friend's house or a LAN party and glimpsed a computer monitor so beautiful that you felt pangs of jealousy wash over you, to the point where you actually checked your arm to make sure you weren't turning green? A bright, crisp monitor with excellent color reproduction is something that you can easily take for granted until you come face to face with one. But once you've basked in the glory of a really, really good monitor, you may as well know that it will haunt your dreams until you give in and bring one home. (This is sometimes referred to as the "The grass is always greener, until it isn't" postulate, and it is totally not made-up science.)

Once you decide it's time to get yourself a good monitor, there are lots of options to

peruse and lots of data to sift through in order to make the right decision, but we suggest that you save yourself the hassle and end your search here and now. The ASUS MG279Q is a gorgeous 27-inch, WQHD 2,560 x 1,440 monitor that is designed specifically for gaming, and it has the design and the technology to provide the experience you are after.

"The MG279Q combines the best gaming features of both TN and IPS panel technology and then some," says ASUS Product Marketing Specialist David Chiang. "You're looking at a monitor that combines the vibrant colors and image fidelity that gamers want for immersive environments and the ultra-high refresh rate needed for nearly uninterrupted visuals."

IP-What Technology?

IPS panel technology. IPS stands for in-plane switching, and it's a technology that was designed to solve problems with older TN (twisted nematic field effect) displays that had great, fast refresh rates but suffered from poor color reproduction and very narrow viewing angles. (Users essentially had to look at them from directly in front or picture quality degraded badly.)

"For gamers who enjoy immersive games like *The Witcher 3* or have dozens of graphical enhancement mods in *Skyrim*, IPS delivers the best possible visual experience," Chiang says. "The tradeoff is that IPS panels were historically limited to a 60Hz refresh rate."



The MG279Q has smart design touches all over; it has a handy set of physical controls (a big plus) that are out of sight but still within comfortable reach. Also, note the vertical channel along the monitor's spine; this is where your cables will go.

We've talked about the importance of higher refresh rates on many occasions in CPU, but Chiang offers a brief refresher: "In short, frequency dictates maximum frame rate," he says. "High frame rates are sought after by competitive gamers especially in FPSes and MOBAs simply because at 144Hz, the translation of control to screen is extremely fluid, allowing for increased accuracy and precision. Traditionally, this is a big reason why gamers have picked TN-panel monitors. There really isn't any benefit to seeing a "120" in the corner of your monitor from FRAPS if you know the hardware is limited to 60Hz."

Chiang didn't throw out that 144Hz figure coincidentally. He mentioned it because that's the MG279Q's refresh rate, and it's part of what he was referring to when he said that the monitor combines the best aspects of TN and IPS technology. The other part is the MG279Q's 100,000,000:1 contrast ratio and its 178-degree viewing angle. At 144Hz, games with lots of stuff moving quickly across the screen (most of them,

in other words) look better because they don't create motion blur. This is aided by the fact that the MG279Q has an impressive 4ms response time. And its 178-degree viewing angle means that if you want to show someone what's going on in your game, they'll be able to see it clearly without moving into BESTIES SELFIE range. In fact, with a viewing angle this wide, you can easily show off your jaw-dropping monitor to a whole crowd of admirers.

FreeSync

You've been hearing a lot about AMD FreeSync technology lately, and with good reason. Although FreeSync isn't the first technology designed to help graphics cards and monitors play nice, it's definitely one of the most effective.

"Graphics cards churn out variable FPS (frames per second) rates, depending on what's being rendered on the screen," Chiang says. "Basically, the more complex the sequence, the lower the FPS will be. Monitors, on the other hand, historically operate at a fixed refresh rate. When a

frame takes longer to render, the monitor may already be in the next frame, which means you're seeing parts of two different frames on the monitor simultaneously."

This is called screen tearing, and it's not your friend. Your eyes are very good at capturing the images in visual range, even when they are moving extremely quickly, and significant screen tearing is at best a mild distraction. At worst it can be a deal-breaker, especially in games where immersion in the game's environment is crucial to your enjoyment of the experience.

"This problem was originally mitigated by VSync, a software solution that caps the FPS generated by the graphics card to synchronize it with the monitor's refresh rate," Chiang says. "The problem with VSync is that it will cause stuttering when FPS generated starts falling below the cap. FreeSync, or adaptive sync, utilizes DisplayPort 1.2a to allow the monitor to communicate directly with the graphics card, syncing what's on the monitor with the FPS of the graphics card, thus eliminating stuttering and screen tearing."

Because FreeSync doesn't cap the graphics card's frame rate, there is no performance penalty tradeoff for eliminating tearing and the like. And although the technology was developed by AMD, the company allows anyone to use it royalty-free; this has led to its adoption by VESA (the Video Electronics Standards Association) as part of the DisplayPort 1.2a specification.

For the moment, though, only AMD GPUs and a select group of monitors work together to implement FreeSync, and the ASUS MG279Q is one of those monitors.

More Cool Features

ASUS has been building hardware for PC gamers for a very long time, and rumor has it that a few of the people on their product teams are known to play the odd PC game themselves now and again. As a result, the MG279Q has a couple more software add-ons that you may find useful and fun. ASUS calls one of them "GamePlus" technology.

"The GamePlus hotkey system essentially allows users to add enhancements to their



ASUS gave the MG279Q a wealth of connectivity options. You'll want to stick with Mini DisplayPort to take full advantage of the monitor's WQHD resolution, but HDMI is an option, and the monitor provides ready access to a brace of USB 3.0 ports for pass-through connections, as well.



This is a monitor that's designed to accommodate you; to provide you with the best viewing experience no matter what kind of space you have, no matter how tall or short your desk and chair are, etc.

games without having to use software and without having to traverse deep into the OSD," says Chiang. "Gamers can choose to add timers to their screen for MMO raids or other timed games. Alternatively, gamers can also choose to add a crosshair overlay on the screen, perfect for those 'training' to no-scope like a pro."

Another MG279Q feature that gamers will appreciate is ASUS' GameVisual technology. GameVisual lets you access up to six pre-set display modes that can improve your visual experience and help you be more competitive in various situations or types of games. The GameVisual FPS mode, for instance, cranks up your monitor's contrast settings so that you can more easily make out your enemies, especially in scenarios and in certain games that tend to be dark. The RTS/RPG setting boosts color saturation and sharpens contrast so that you can more easily make out distinct unit types, even when there are lots of units onscreen at once. There are also Racing (reduces input lag), Cinema (enhanced contrast and color saturation), Scenery (boosts brightness settings and tweaks colors common in scenery photos and film), and sRGB (settings optimized for viewing photos) settings.

Finally, ASUS added a feature designed to lend a helping hand to those of us who tend to play for large chunks of time without taking the breaks we probably should; it's called ASUS Ultra Low Blue Light. This feature uses five settings with varying filters to protect you from harmful blue light in different usage scenarios.

"The Ultra Low Blue Light feature is part of the ASUS Exclusive EyeCare solution, with functions designed to make even marathon gaming sessions comfortable to the eye," Chiang says. "The beauty of the ASUS EyeCare solution is that it only removes the stress-inducing frequencies in the blue light spectrum, meaning the picture stays intact. EyeCare also utilizes DC instead of PWM for brightness control, removing the nearly imperceptible flickering, further removing eye stress over time."

Physical Design Mojo

As handy as all of the MG279Q's software features are, the physical design of the monitor may be even more impressive; the monitor is designed to give you an incredible range of configuration options, and to make using it as convenient as possible. For starters, the monitor comes with a wealth of connectivity options and a simple yet highly effective built-in cable management system.

The monitor's Mini DisplayPort 1.2 port provides native WQHD output,

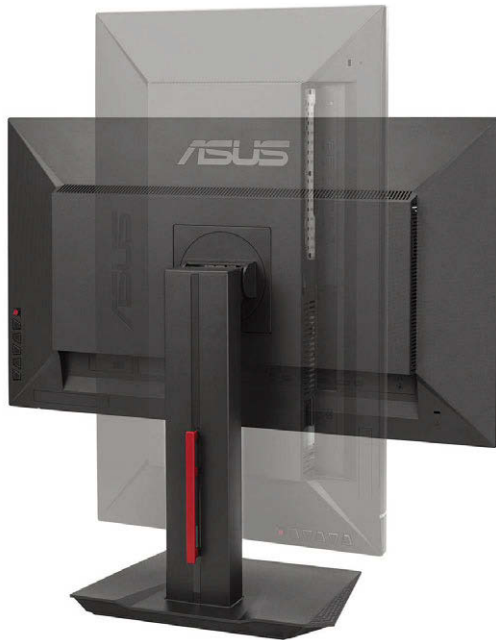
spaghetti taking up room on their desk. The smart cable management feature is part of ASUS' continued philosophy of building products from the consumer's viewpoint. Simply bundle cables from your computer, monitor, keyboard, and mouse into the cable channel and now you've got just one big cable to deal with. Personally, I prefer to add cable ties along the length to ensure it stays neat all the way to the PC."

ASUS knows that every gaming area is just a little different, so the company designed the MG279Q to be

clockwise for portrait orientation), and you can adjust its height from 0 to 150mm. In other words, there's almost nowhere you can put this monitor and not still have a good, comfortable view of it, and that's good news for folks whose gaming setups are packed in little sub-staircase nooks or who have non-standard desks and/or chairs.

"As with ASUS EyeCare, the MG279Q's ergonomics are designed for comfort, as angle and distance from the user significantly affects eye stress," Chiang says. "As the MG279Q is engineered to accommodate multi-monitor setups with its thin bezel design, having these adjustments really allows the MG279Q to fit into an existing or new setup without any trouble."

If you somehow manage to defy the odds and discover that you really can't find a way to situate the MG279Q on its stand that works for you, you can lose the stand and mount the display on your wall using its VESA mount.



The MG279Q's ultra-thin bezel makes it a great candidate for a multi-monitor setup. And because you can rotate it a full 90 degrees clockwise, a multi-portrait config is an option, as well.

Quality Is Value

It's easy to toss the cheapest monitor you can find at your desired screen size into your shopping cart, almost as an afterthought, when you are reeling from the sticker-shock of buying the parts for a new build. But when you consider how many hours you will spend staring at your monitor—and let's face it, your monitor is the primary way in which your PC interacts with you—is that really your best option?

The ASUS MG279Q isn't the cheapest 27-inch monitor you'll find on the shelf at your local parts store or your favorite online retailer. But did you buy the cheapest graphics card you could possibly find? The cheapest power supply?

First and foremost, the MG279Q is a great monitor from a visual standpoint, but when you add up its cutting-edge features, FreeSync support, flexible setup options, and its three-year warranty, ASUS is betting that you'll find you can't afford to settle for anything less. ■

and you also get a pair of HDMI ports that are also MHL-enabled, meaning that you can connect smartphones, tablets, and other portable devices to the monitor should the mood strike you or the need arise. The MG279Q also sports a pair of USB 3.0 ports in case you find a need for or can benefit from pass-through USB connectivity.

The cable management system is deceptively simple in appearance, but handles an important task: "Let's be frank," Chiang says. "No one likes cable

highly flexible. Want a multi-monitor setup? Hey, you're not the only one, so ASUS gave the display an extremely narrow bezel, so that if you plunk three of them down on your desk end to end, there will be only the slightest interruption in your picture moving from one side to the other.

In addition, the monitor's cleverly designed stand tilts vertically (+20 degrees to -5 degrees), swivels horizontally (+60 degrees to -60 degrees), and pivots (up to 90 degrees

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Kill It With Water

Use Liquid-Cooling To Beat The Heat

Summer is the season of projects. Kids occupy themselves with exploring the neighborhood or undertaking an ambitious LEGO (or Minecraft, or LEGO Minecraft) creation. Adult projects are often less enjoyable, whether that's staining the deck or renovating the 80s-era bathroom.

For PC enthusiasts, "project season" wouldn't be complete without beginning a new adventure with their computer. The best part about a PC project is that it can be educational (learning to code), artistic (case modding), or pragmatic (setting up a NAS). Whatever you choose to do, try to make it fun. This is supposed to be a hobby, after all.

Might we suggest liquid-cooling your PC? There are practical benefits: A processor with an unlocked multiplier will reach new heights using custom liquid-cooling, and the right setup can run much quieter than an old stock air cooler. And even if you don't really need a faster or quieter PC, upgrading your system to watercooling is simply cool as hell.

There are two roads that lead to liquid, and one is quite shorter than the other. Your first option is a closed-loop cooler, often alternatively referred to as an AIO (all-in-one) cooler. As it turns out, both of these labels are instructive in their own way. The latter refers to the fact that the primary components of a liquid-cooling loop—waterblock, pump, and radiator—are assembled at the factory and installed together as "one" component. The former, "closed loop" means that the cooler is also prefilled with coolant at the factory, and users aren't intended to open the cooler to perform maintenance tasks such as draining and filling the loop; it's closed off, if you will.

Closed-loop liquid-cooling does have a number of advantages, but it's not for everyone. If you like having total control over your system cooling, a custom loop is the only way to go. With a custom loop, you're in charge. If you like Stark Industries'

waterblock, Lexcorp's radiator, and Wayne Enterprises' pumps, you can buy them separately and install them together. If you want a 480mm radiator and your case can contain it, nothing is stopping you from using it for your custom loop. This approach imposes few limitations, but most of the responsibility rests squarely on the enthusiast's shoulders.

As we discuss the benefits and drawbacks of each type of liquid-cooling, keep in mind that there's no perfect solution for everyone. You can get your feet wet with either, so let us help you with the shopping list and guide you through the process.

Closed Or Custom?

You don't need to agonize over buying a closed-loop liquid-cooler or building a custom loop, because picking one over the other will likely vary according to your circumstances.

Money, time, and your case's interior are all factors, and each type of liquid-cooling has distinct advantages and disadvantages.

Liquid-cooling doesn't need to be complicated or expensive: That's the tao of closed-loop liquid-cooling. Because most of the individual components of a liquid-cooling loop are already assembled, installing a closed-loop cooler really only consists of mounting the cold plate/pump unit to the motherboard's CPU socket and the radiator to the case. It's not an exaggeration to state that if you can install an aftermarket air cooler and add extra case fans then you can install a closed-loop liquid-cooler. Plus, even the cheapest cases today have motherboard tray cutouts and fan mounting holes that make installing a closed-loop cooler easier still.

The actual setup process (which we'll explain here, since it's so much less involved



Behold Thermaltake's Pacific RL240 watercooling kit—everything you need to assemble a killer custom liquid-cooling system, all in one box. Custom kits are an especially great option for beginners, since they take much of the guesswork out of selecting individual components.

than a custom loop) starts with installing mounting hardware, which typically consists of some combination of a backplate and/or threaded posts. After these are in place, you should inspect the cooler's cold plate to check for thermal interface material. Some manufacturers will preapply a thin layer to the cold plate, but others will include a small syringe of TIM for you to apply to your CPU. Either way, there has to be some form of TIM between the cold plate and the CPU's integrated heat spreader. You'll use mounting screws on the posts to secure the cooler's cold plate/pump unit. Depending on the size of the radiator included with the closed-loop cooler, the best place to mount it is either the case's rear or top panel. Lots of closed-loop coolers include screws that let you combine the radiator with your case's existing fans, increasing the cooler's performance.

Once you've mounted a closed-loop cooler, you can forget about it for years, which is another selling point: Closed-loop coolers require little to maintenance, as opposed to custom loops, which many experts recommend refilling with fresh coolant on a yearly basis.

Finally, buying a closed-loop cooler is considerably less expensive than purchasing individual liquid-cooling components for a custom loop. Broadly speaking, closed-loop coolers range in price from \$75 to \$150; prices vary based on the size of radiator, number of fans, and so forth. By comparison, you could easily spend that much on a waterblock alone for a custom loop.

The chief limitation of closed-loop liquid-coolers is that you can't upgrade or expand them. (There are exceptions, but they are few.) If you decide you want a more powerful pump, larger radiator, or clear tubing with tinted coolant, a closed-loop cooler will put a stop to your upgrade plans before they can even start. Because of this, the only way to increase the performance of a closed-loop cooler is to buy a better closed-loop cooler.

A custom loop flips the script. Nearly unlimited expandability (provided your case allows it) is one of the best reasons to build your own loop. If you want to change your pump or radiator, for example, you can do so without having to ditch your waterblock



For watercooling rookies, closed-loop liquid-coolers, such as this LEPA AquaChanger 240, are even easier. Closed-loop coolers are assembled at the factory, so the installation process consists of attaching fans to the radiator, then mounting the radiator and pump/cold plate unit to their respective locations.

in the process. Maybe you feel like adding your graphics card(s) to the loop. It's possible with custom liquid-cooling.

With that expandability, you can add and/or upgrade a custom loop to increase performance. In fact, you have to go custom to deploy the big guns—super-sized radiators, towering reservoirs, and whisper-quiet pumps. Truly outrageous cooling performance requires investing in top-shelf liquid-cooling components and uniting them in a custom loop.

There's an artistic element to custom loops, as well. Closed-loop liquid-coolers aren't at all unattractive, but we've seen builders and modders make visually stunning custom loops that simply aren't possible with closed-loop cooling. Tinted coolants, anodized fittings, and an assortment of waterblock top finishes are at your disposal with a custom loop.

Feel like taking the plunge into custom watercooling? Good, let's assemble the team.

Roll Call

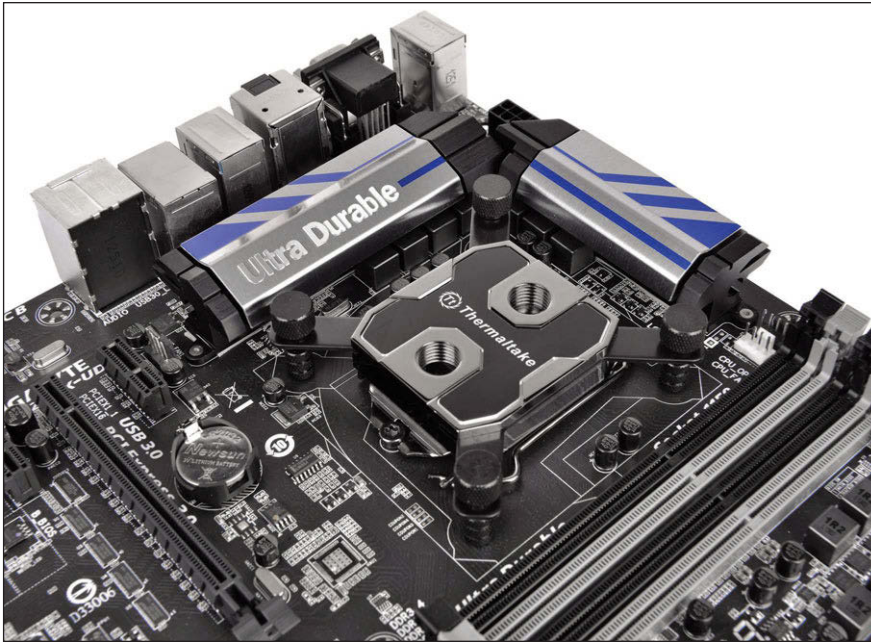
If your experience with system cooling is the heatsink and fan included with your

processor, then prepare yourself to meet the cast of characters that come together to make custom liquid-cooling possible. Each component has an important job to do.

Waterblock. Think of the waterblock as your loop's point man. The waterblock is naturally the first component to encounter heat from the component(s) you need to cool. All waterblocks will share at least one thing in common: a copper base. Copper is a better conductor of heat than aluminum, so there is wide agreement among power users that it must be used as the base of the waterblock.

Aside from socket compatibility, you should look for a waterblock that maximizes heat absorption, and in addition to using a copper base, manufacturers have developed a few tricks to accomplish this. A good waterblock will have a series of small microfins inside; these increase the surface area within the waterblock, which in turn allows more coolant to come in contact with the block. Manufacturers may also build their waterblocks to increase the turbulence of the coolant as it travels through the blocks.

Although CPU waterblocks are almost universally compatible with every current



Pictured above is Thermaltake's Pacific W1 CPU waterblock. An essential element of any custom liquid-cooling loop, the waterblock is designed to absorb heat from the CPU's integrated heat spreader and transfer it to your loop's coolant.

desktop processor, GPU waterblocks are an entirely different animal. Obviously, you have to select a waterblock that corresponds to your particular GPU, such as the GeForce GTX 980. But if your graphics card uses a non-reference design, you must double-check the GPU waterblock you want will work with your specific card. Non-reference graphics cards frequently use different component layouts on their PCB, which can cause major problems for GPU waterblocks.

Radiator and fans. A waterblock and the coolant that runs through it do a great job of absorbing heat from your components, but they have to do something with that heat to keep your hardware from cooking. This is where the radiator comes in. Radiators are responsible for dissipating the heat that builds up in your loop's coolant, which in turn lets the coolant absorb more heat from the CPU, GPU, etc.

A radiator's dimensions play a big part in determining its cooling performance. A bigger radiator means more heat dissipation, after all. The most common radiators use 120mm or 140mm fans, and their size is listed as some multiple

(e.g. 240mm, 360mm, etc.) of either of these dimensions. As a general rule of thumb, should increase the size of your radiators as you add components to your loop or if you desire more overclocking headroom. A 120mm rad will be adequate for cooling the CPU, but a 240mm unit is much better for serious overclocking and/or adding a GPU waterblock.

Finally, radiator thickness and fin density are also important. Both of these are consistent with the "mo' radiator, mo' betta!" notion: The former increases the amount of heat the radiator can dissipate, while the latter, expressed as fins per inch, increases the radiator's surface area.

In order for the radiator to really do its job, however, it needs help from fans. Depending on your radiator's size and the case fans in use in your system, you might be able to combine the two and save a little money. Otherwise, you should at least buy enough fans for one side of the radiator. (If you have enough clearance, you can install fans on both sides of the radiator for even better performance. This is called a "push-pull" configuration.) The key fan specification that

will most benefit a radiator is the fan's static pressure—the higher the better. However, fans that produce relatively low static pressure won't severely hamstring your loop's performance, so don't neglect other factors that could be important to you, such as matching the rest of your build's color scheme.

Pump. The biggest radiator and baddest waterblock are useless without a good pump to keep the coolant flowing. A custom loop's pump is responsible for circulating coolant through each waterblock, sending it to the radiator where it can discharge the heat it's carrying, and then blast the newly cooled coolant back to the waterblocks to repeat the process.

Picking the right pump involves balancing its maximum flow rate and pressure with the noise it produces. You want a pump that's strong enough to account for pressure drops as the coolant passes through each component of your loop, but if your pump generates more water pressure than you need, there's a good chance it's also generating more than enough noise, as well.

Thankfully, the online community has developed solid resources for determining exactly how much pump you need. This is one instance where we recommend searching for pump buying tips online, because the topic is more extensive than you might think.

Reservoir. One of the few truly optional components of a liquid-cooling loop (notice that closed-loop coolers don't rely on them?), reservoirs can hold a surplus of coolant, but don't confuse extra coolant with better cooling performance. They're not the same thing, and adding a gigundous reservoir won't lead to record-breaking overclocks.

So, what exactly does a reservoir do, besides look pretty? Despite being optional, a reservoir is nonetheless a very useful component. It makes filling your loop much easier, and air bubbles will bleed out much faster in a loop that has a reservoir than one that doesn't. For these reasons, we like use a reservoir when building any custom liquid-cooling system.

Fittings and tubing. These two components work hand in hand. Technically, you should be able to buy what you need from a hardware store, but we recommend purchasing tubing and fittings from

a company that specializes in serving the enthusiast market. Yes, you'll pay a premium, but you'll get hardware that's been developed especially for liquid-cooling a PC.

Making sure your tubing and fittings are compatible is job one, but it's also pretty simple. If you plan to use compression fittings (which we prefer), you need to buy fittings that match both the inside and outside diameter of the tubing you choose. If you opt for hose clamps, your barbs must match the inside diameter, and you'll get the best results by matching the clamps to the outside diameter of the tubing.

You'll encounter another specification on your hunt for fittings: G1/4. This refers to the fittings' threading. Your fittings' threading must match the components—waterblock, radiator, etc.—you intend to use them with. G1/4 is the *de facto* standard now, though, so it's unlikely you'll find liquid-cooling components that don't have this threading.

Coolant. At this point, component and/or budget fatigue may be setting in. We get it. Building a custom liquid-cooling loop is an involved process. If you're interested in a quick fix, score a gallon of distilled water; it'll do the trick, at least in the short to medium term.

Over the life of your system, though, we can make a pretty good case for purchasing specially formulated coolant from a manufacturer. Whether you buy a concentrated bottle to mix with distilled water or a container that's been premixed and is ready to pour into your loop, coolant designed for liquid-cooling includes anticorrosive and antimicrobial agents that should cut down on how frequently you need to flush and fill your loop with new coolant. And of course, vendors offer a rainbow of tinted coolant that you can match to the rest of your system.

It's A Setup!

Anyone who's been to a LAN party or visited a modding forum can tell you that custom loops have a habit of being bombastic. It's an addiction for a lot power users, who don't stop at liquid-cooling their CPU. Adding graphics cards to the mix is a popular setup, and liquid-cooled RAM and motherboard chipsets are common sights, as well. The most grandiose loops usually

include multiple radiators and pumps, huge reservoirs, and rigid tubing complete with complicated bends. For this article, our designs are considerably less ambitious. We want to introduce you to custom liquid-cooling, not overwhelm you with it. As such, we'll restrict our focus to liquid-cooling the CPU.

We like to start by installing our barbs in all of our components. This is especially helpful if you have to install any of your liquid-cooling hardware in a tight space. At this point, you should also inspect your radiator and reservoir for any additional threaded holes. These will either be drain ports, fill ports (on a reservoir), or extra G1/4-threaded holes. In these cases, the manufacturer should have included stoppers for you to block off any holes you don't intend to use in your loop, so install them, too. (You can leave your reservoir's fill port open for now, obviously.)

Next, you'll want to build a "road map" for your tubing, and installing your liquid-cooling components without any tubing attached is the way to do. At the very least, we like to install our motherboard as well, since it helps you get a fairly accurate position for your loop's CPU block. Temporarily installing your graphics card(s) will also help you plan your tubing runs. Determine how much tubing you need to connect everything together, erring on the long side. (Remember, you can always trim tubing that's a little longer than what you need. Putting it back on is a different, sadder story.)

If you've mocked up your loop and are satisfied with the layout, start cutting and attaching the tubing. By dipping the ends of the tubing in hot water for a few seconds, you can slip them over the barbs much more easily. Remember to slide your compression fittings over the tubing before installing the tubing. Once you have the tubing over a given barb, tighten the compression fitting or clamp to create a watertight seal.

Once all of your tubing and fittings are attached, you can begin filling your loop. Carefully pour coolant into your reservoir until it's nearly full. Next, you have to "push" some of the coolant into your loop. That means your pump needs power, but you also don't want to completely power on your system in case you have any leaky connections.

To do this, you need to "trick" your power supply into thinking it's powering your full system. Start by connecting your loop's pump to your power supply. Then, you have to bridge your PSU's main ATX connector PS_On (green) wire to any of the connector's ground (black) wires. You can easily MacGyver this with a paper clip, or you can buy a PSU bridge tool if you're more of a MacGruber. Once you've bridged the PS_On wire, you can turn on the power supply. If you completed the bridge properly, only the pump should turn on. Temporarily cap your reservoir's fill port and hold onto your chair.

As your pump roars to life, you must keep a close eye on the coolant level of your reservoir. You don't want to pump out the entire reservoir, because this can easily result in the pump running dry, which will fry it in a hurry. Turn off your power supply once you've pumped the majority of the reservoir's coolant into the loop. Then, fill the reservoir again and repeat the process until the pump can run continuously without reducing the coolant level in the reservoir.

A loop full of coolant is ready to leak-test. We prefer to do this before installing any other components, even if we leave them powered off. To leak-test your loop, turn it on and let it run. The general consensus among power users is 24 hours of continuous operation. At that point, any leaks, however small, will have shown up. If your loop stays dry after a full day of leak testing, it's ready to start earning its keep.

Finally, install your system components, attach the waterblock to the CPU (don't forget the thermal paste; apply it the same way you would with an air cooler's heatsink), and turn on your PC. Your brand-new liquid-cooled rig is finished.

Let The Good Times Flow

The appeal of liquid-cooling is different for different kinds of enthusiasts. Performance fiends love the ability to push their components harder. PC artists insist on liquid-cooling because it gives them one more way to distinguish their masterpieces. Whatever your motivation, having a liquid-cooled PC is undeniably awesome. ■

From PCB To Motherboard

A Visit To GIGABYTE's Nan-Ping Factory

When we cover GIGABYTE's motherboards in CPU, we often write about the top-notch power handling hardware that helps to provide rock-solid system stability. These assessments are based on the transistors, capacitors, and silicon found in the motherboards, but when it comes to reliability and durability, the manufacturing process matters, too. During our visit to Taipei for Computex, GIGABYTE invited us to take a tour of its Nan-Ping factory where a good portion of its motherboards are made, and we got to see how GIGABYTE transforms a mere PCB into a cutting-edge motherboard.



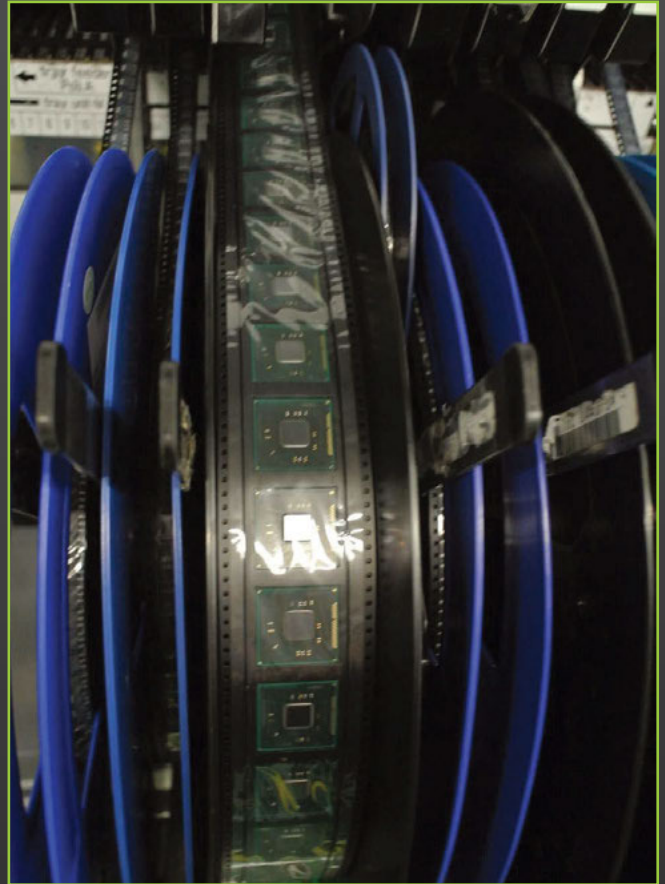
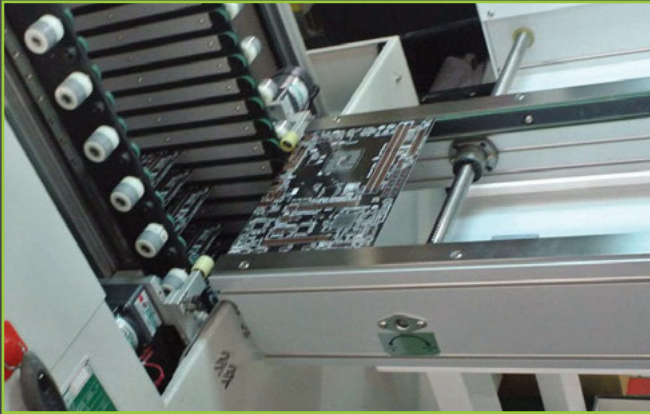
Some of the biggest PC hardware manufacturers in the world are based in Taiwan, yet the actual production facilities are often found on mainland China. GIGABYTE takes pride in the fact that it's the only motherboard company that still manufactures its motherboards in Taiwan. The company's Nan-Ping facility is located just an hour away from Taipei, and this eight-story building is used to produce motherboards, graphics cards, servers, laptops, and smartphones, among others.

GIGABYTE employs a skilled workforce at its Nan-Ping facility, as more than 70% of the employees have been with GIGABYTE for at least 10 years. A further 23% have between five and 10 years of experience, leaving only 7% of its workforce with less than five years of experience. During our tour, we got to see the complete motherboard PCB assembly process, which included the SMT (surface mounting technology), DIP (dual in-line package), FCT (functional testing), and packing lines. At Nan-Ping, GIGABYTE is capable of producing 400,000 motherboards per month.



HARD HAT AREA

Here, you can see the PCB before GIGABYTE has added any components. This board is about to go through a series of SMT machines that will put many of the integrated circuits, solid-state capacitors, and other tiny tech onto the motherboard. Reels of the tiny parts are fed into the machines, where servo arms inside place the components onto the board. With larger parts, like chipsets and sockets, the machines pick circuits off a rack for placement. It's an incredibly fast process; it only takes a few minutes for the SMT machines to precisely place hundreds of components.



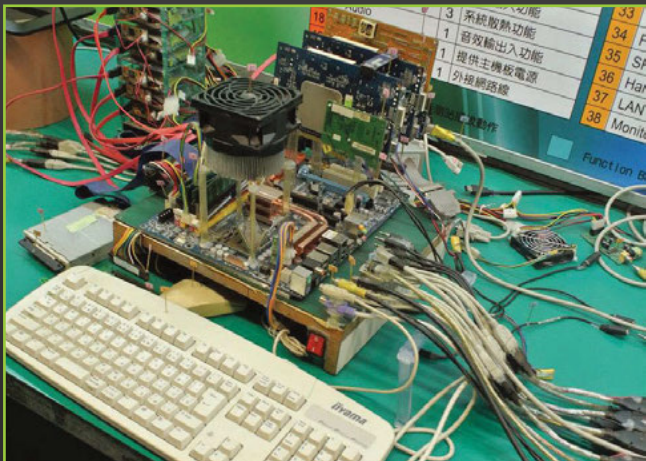
The boards pass through a convection oven where the solder paste (added to the board before it went through SMT machines) melts and solders the SMT components in place. Next comes the circuit testing; a machine with a built-in rack lowers the board into place, and a technician running the machine makes certain that current is effectively passing through the electrical parts. Finally, another technician will visually inspect the PCB to make sure the board is ready to move on.



The next step in a GIGABYTE motherboard's journey is one floor down at the DIP line. Here, workers manually insert components, such as the rear I/O sockets and SATA ports, which must be plugged into predrilled holes. We got a chance to try out this job after the tour with some blank PCBs and six components to manually install. Factory workers are expected to install the parts in five seconds or less. This job requires some serious hand-eye coordination. Afterwards, the motherboards go through a wave-soldering machine and inspection.



Another floor down, GIGABYTE completely tests the motherboard for functionality via test benches like the one seen here. There's also a burn-test phase, as well as one final inspection. Assuming a motherboard passes all of these tests, it's off to packaging. Here, workers box up the motherboard and manually add all of the necessary accessories and software. Lastly, the motherboard boxes are loaded up into large shipping boxes that'll bring the completed and packaged motherboards to their next destination.



Quality Assured

As you can see, GIGABYTE makes certain that any motherboard you receive has passed numerous tests and inspections before it gets to you. It's truly amazing how quickly the whole process goes, as well as how quickly and efficiently workers can manually place the tiny components onto the boards. The whole process certainly gave us a new appreciation of how motherboards are made. ■

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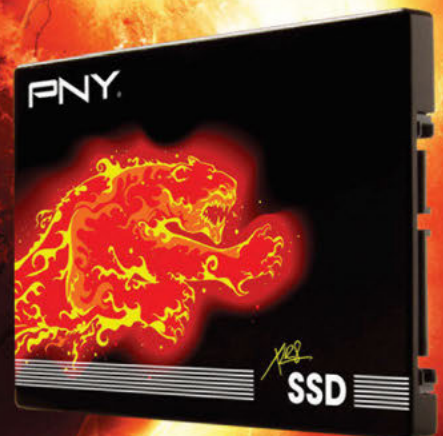
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Upgrades That'll Keep You Humming Along

A wild kingdom of programs named after animals receives updates this month. This month's zoo consists of Data Crow, EagleGet, and GreaseMonkey. Other updates give you greater insight into your hardware and help you keep tabs on your ever-increasing library of passwords. GeForce and HDHomeRun owners get a new driver and firmware, respectively.

SOFTWARE UPDATES

Data Crow 4.0.16

The first update in almost six months adds TheGamesDB.net online videogame database to its already impressive roster. Data Crow 4.0.16's other big addition is that the datacrow.credentials file can be used to submit server credentials. This update also fixes a lot of bugs, including enabling the Stop button when a Mass Update task starts and letting you import pictures from MobyGames.com's database. The Brazilian and Portuguese translations of Data Crow have been updated, as well.

www.datacrow.net

EagleGet 2.0.4.0

In addition to making downloads soar, EagleGet can also swoop in and snatch online videos from websites with ease. Version 2.0.4.0 makes improvements to EagleGet's data transfer engine, resulting in even faster downloads. The new and improved bird plucks a few pesky bugs from its feathers, as well. Certain HTTPS links and large files should no longer confound EagleGet, and the Opera browser extension should now run much smoother.

www.eagleget.com

Filezilla Client 3.11.0.2

A pair of updates over a 10-day period to the open-source FTP client patched a vulnerability to protect it against attackers and fixed a few bugs, too. To wit, with the previous update, 3.11.0.1, FileZilla will now reject Diffie-Hellman Groups smaller than 1,024 bits when using FTP over TLS; this fix was designed to thwart Logjam attacks. The newest version should be more

compatible with servers that send pre-epoch timestamps, and now FileZilla won't crash if you remotely close one connection while simultaneously opening another.

<https://filezilla-project.org>

GreaseMonkey 3.2

Firefox fanatics love the GreaseMonkey extension, and it's easy to see why. This little simian gives power users the ability to customize web pages' appearance and functionality. In addition to stomping a lot of bugs, the latest releases adds quite a few features. For example, you can now adjust @match rules in the script settings, and script updates will now check the server rather than the browser's cache. Finally, the GM_openInTab() API now supports the open_in_background argument.

www.greasespot.net

HWiNFO v4.64

If you need details—no matter how trivial—about your hardware, there's a better than average chance HWiNFO can hook you up. Version 4.64 adds the ability to collect and report below-zero temperatures (for LN2 overclockers) as well as lots of memory-related reporting for Intel's Skylake platform. NVIDIA's recently released GeForce GTX 980 Ti is now supported, too.

www.hwinfo.com

Sticky Password for Windows 8.0.4.34

A pair of updates recently rolled out for this password manager. The current update corrects a bug that would cause the program to crash if the tutorial was

removed from the installation folder. The previous build, 8.0.4.33, increased download speed and introduced the ability to support double-byte characters in Windows user profiles. Build 8.0.4.33 also repairs a bug that caused Internet Explorer 11 to crash under certain circumstances.

<https://www.stickypassword.com>

DRIVER BAY

NVIDIA GeForce 353.06 WHQL

NVIDIA's new graphics driver coincides with a couple of highly anticipated releases, namely the GeForce GTX 980 Ti and Heroes of the Storm. In the case of the latter, GeForce owners can hit the arena running, as this new Game Ready drive adds 1-click optimizations for Blizzard's new "hero brawler." The driver also introduces a host of G-SYNC features, including support for G-SYNC when playing games in windowed mode, support for Ultra-Low Motion Blur, and Dynamic Super Resolution.

www.nvidia.com

SiliconDust HDHomeRun Firmware 20150604

This firmware update provides SiliconDust's HDHomeRun devices with a slew of improvements. The DLNA media server now includes channel logos. SiliconDust has also enhanced diagnostic logging, and HDHomeRun VIEW and DLNA clients boast improved buffering capabilities, as well. The firmware should also boost the HDHomeRun boxes' compatibility with proxies that don't fully support HTTP/1.1.

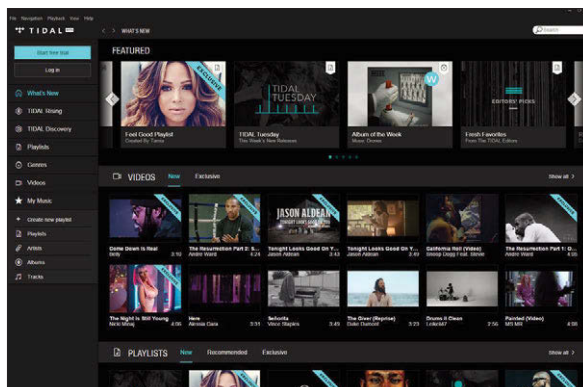
www.silicondust.com

Inside The World Of Betas

TIDAL FOR WINDOWS

Does the world really need another music streaming service? We already have Pandora and Spotify and Google Play Music and . . . well, you get the idea. And with Apple's recent announcement to jump into the market, two gigantic feet first, what chance does a fledgling service have? Despite going up against not one, but several juggernauts, hip-hop mogul Jay-Z's TIDAL has a few interesting weapons in its arsenal.

The Jigga Man throwing his Yankees cap into the ring isn't exactly news to anyone with even a passing interest in either the music or tech scenes. You might've also heard that the artist legally known as Shawn Carter has teamed with a host of other A-list musicians to form an "artist-owned" streaming service. Now let's be clear: This doesn't mean your third cousin Pierre's zydeco band has any kind of ownership stake in TIDAL, but it does mean Jay & Co. are purportedly paying artists a royalty rate higher than other services.



TIDAL For Windows
Publisher and URL: Aspiro;
tidal.com

ETA: TBD

Why You Should Care:

Access to loads of exclusive content and celebrity-curated playlists help distinguish Jay-Z's new music streaming service from the competition.

Another advantage that TIDAL has touted early and often is its hi-fi streaming plan (\$19.99/month), which lets subscribers stream CD-quality lossless songs to their device(s) of choice. Early access to music videos and exclusive concert tickets are other perks.

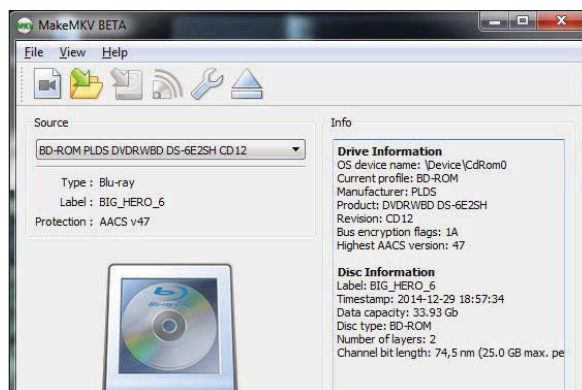
The beta release of TIDAL For Windows brings TIDAL to the desktop. (Mac owners will be happy to know that the desktop app

is also in beta for OS X.) The software itself "works," and by "works" we mean that it certainly seems polished enough to roll out to masses for general consumption, despite its beta status. But for the software to *really* work, you have pay up. Yes, a 30-day free trial is available, but unlike services like Spotify, there's very little you can do without a paid subscription. ■

GUINPINISOFT MAKEMKV 1.9.3 BETA

Although MKV might not be as well-known as its fellow file containers, such as MP4 and AVI, the format nonetheless maintains a passionate following, especially among HTPC enthusiasts. Short for "Matroska," MKV is popular largely because it's a 100% open standard. There are no MKV license holders, so users are able to use it however they want and on any device they want (provided the device supports the format, naturally). MKV files are also free of HDCP encryption and are not region-restricted.

Power users who want to convert their library to MKV need a transcoder to do the heavy lifting. That's where MakeMKV comes in. MakeMKV is simple in purpose yet powerful in performance, chewing up DVDs and Blu-rays and spitting out MKVs as fast as your optical drive can read them. The resulting files are typically 10% smaller than DVD files and 40% smaller



MakeMKV 1.9.3 Beta

Publisher and URL:
GuinpinSoft;
www.makemkv.com

ETA: TBD

Why You Should Care:

Serious movie buffs will find MakeMKV to be an indispensable tool for their utility belt.

than Blu-ray files. MakeMKV also keeps all chapter information and metadata intact during the transcoding process.

The latest beta adds polish here and stomps bugs there. With regard to the latter, transcoding multichannel FLAC audio should work without issue, and a pair of wrinkles in the Windows version have been ironed out, as well. Along with continuously

checking Blu-ray M2TS hashes, MakeMKV is now able to better deal with discs that have mastering errors.

Although it might not be packed full of bells and whistles (seriously, its name is not an understatement), and the interface is nothing fancy, MakeMKV powers through discs like a boss and is a breeze to use. The latest beta is more of the same. ■



TRISTELLAR

To be pioneer



Tristellar disrupts the traditional concept of a PC case, splits components into three cabins; three high ness "V" shape metal frames and full metal shells ensure Tristellar has a reliable and solid structure, the system is not only for an artistic appearance, but also a great cooling performance by separating the most heat-generating parts of a PC. The case supports the latest gaming configuration, it is an excellent choice for gamer or PC builder who want a case with both high performance and aesthetics.

A Game Of Games

Fantasy Esports Becomes A Reality

In September 2014, just as Amazon was finalizing its \$1 billion acquisition of Twitch, ESPN's President John Skipper famously said of eSports, "It's not a sport—it's a competition. Chess is a competition. Checkers is a competition. Mostly, I'm interested in doing real sports." Despite Skipper's comments, ESPN2 broadcast a collegiate-level Heroes of the Storm tournament earlier this spring, titled Heroes of the Dorm, complete with color commentary, amid its usual spate of SportsCenter reruns and talk shows from the likes of Colin Cowherd and Keith Olbermann. While gamers and power users in general may be familiar with competitive electronic gaming and might even enjoy streaming or even attending live events, many of the fans of ESPN's traditional sports programming were . . . not a fan.

Whether you consider League of Legends, DOTA, or CS:GO tournaments "real sports," the fact of the matter is, eSports is rapidly growing in popularity, and there are more and more parallels that can be drawn between this fledgling form of entertainment and televised sportsball competitions like football, baseball, soccer, hockey, and basketball.

The Fantasy Angle

One of those parallels is the rise of eSports betting and the eSports equivalent of fantasy sports. For the uninitiated, the traditional form of the latter activity involves participants in groups each acting as a team owner and drafting active players in a given sport prior to the start of the season. During the weekly games, two of these fantasy teams are matched head-to-head, and the various players (and teams) accumulate points based on their performance in the televised games. An abbreviated form has cropped up in

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HOW TO PLAY ALPHADRAFT

OBJECTIVE: YOU HAVE A \$50,000 SALARY CAP TO SELECT PLAYERS FOR YOUR FANTASY LINEUP (6 PLAYERS & 1 TEAM). YOUR LINEUP EARNs FANTASY POINTS BASED ON THE PLAYERS ACTUAL PERFORMANCE DURING GAMES. YOUR LINEUP COMPETES AGAINST OTHER LINEUPS ENTERED INTO THE CONTEST AND RANKING IS DETERMINED BY YOUR FANTASY POINTS.

EVERY CONTEST HAS GUARANTEED WINNERS AND PAYS OUT MONEY!!

STEP 1: JOIN A CONTEST

FROM THE MAIN LOBBY, CHOOSE A CONTEST YOU WOULD LIKE TO ENTER.

LEAGUES	ALL LEAGUES	SEARCH	CONTESTS	ENTRY FEE	TOTAL PRIZES	TOP PRIZES	LIVE IN	ENTER CONTEST
Star HD's Make Money, Get Paid EU W8000			€225,000	\$0	\$4,500	\$1,000	88:05:51	ENTER
ProtabMaster's TK Challenge EU W8000			€981,000	\$5	\$4,500	\$1,000	80:05:51	ENTER
Track20's HD Payroll Tournay NA W8000			€661,000	\$5	\$4,500	\$1,000	140:15:51	ENTER
OverGanger's Spin Tournay EU W5000			€30,150	\$0	\$1,750	\$500	06:05:51	ENTER
Burner's Big Win Tournay EU W5000			€401,000	\$1	\$800	\$300	66:05:51	ENTER
Blakem's Mission Kill Tournay NA W5000			€331,000	\$1	\$800	\$300	18:15:51	ENTER
Defenso's Mission Kill Tournay NA W5000			€661,000	\$1	\$800	\$300	140:15:51	ENTER
FREE Practice Battleground EU Day 1 EU Week 9 Day 9			5,580,42,000	FREE	\$300	\$0.10	66:05:51	ENTER
FREE Practice Battleground EU Day 2 EU Week 9 Day 21			4,222,12,000	FREE	\$300	\$0.10	80:05:51	ENTER

STEP 2: CREATE A LINEUP

BUILD THE BEST LINEUP YOU CAN! PICK 6 PLAYERS AND 1 TEAM FOR YOUR LINEUP. BUT REMEMBER YOU MUST STAY UNDER THE \$50,000 SALARY CAP.

Deposit now and we'll match your first deposit up to \$250! [Redeem Deposit Bonus](#)

Most fantasy eSports sites follow a format that's instantly recognizable to players of traditional fantasy sports.

recent years called daily fantasy sports, or DFS for short, which takes the typical season-long fantasy sports formula and crams it all into a daily, or in the case of professional football, weekly cycle.

Websites that support daily fantasy eSports all have their own take on eSports betting, but generally they all let registered users view lists of sanctioned events, pick a handful of professional gamers to form a team or pick an existing team, and then use their team to bet on the outcome of various tournaments broadcasted online. Typically, these events are hosted and heavily sponsored by the game developers and publishers, so they are often single-game tournaments.

Fees are charged, and winnings come in the form of cash, with the amounts depending on the form of bet placed. That's right, folks, in 2015, we've figured out a way to gamify the act of watching other people play games.

What Is DFS?

To understand this new facet of eSports, it's important to look at the phenomenon's roots. In this case, daily fantasy eSports is closely modeled after DFS for baseball, football, and other professional sports. According to a recent poll, approximately 42 million people in the United States and Canada participated in fantasy sports in 2014.

Drafting a team of pro gamers and competing against other players' teams is easy on AlphaDraft's website.

Vulcan lets you earn virtual currency, which you can use to win real money, for logging on and completing quests.

Although the number of people who play DFS is generally considered to be smaller, DFS—like daily fantasy eSports—is growing in popularity, largely due to the minimal time commitment. In most cases, you can create a team, place your bets, and get results that same day.

One of the most influential sites in the DFS world is FanDuel (<https://www.fanduel.com>). As we went to press, FanDuel boasted more than 20,000 leagues available every day for players to join, instant payouts as soon as the league ends, minimum buy-in starting at \$1, and over \$10 million in cash prizes each week. Don't want to commit cash as you learn the ropes? FanDuel lets you participate in free leagues, as well, and even offers a money-back guarantee if you're not satisfied after your first league. FanDuel follows the popular salary cap format, in which users have a set amount they can spend on individual players in a given sport, for instance \$50,000. The most valuable players, or those most likely to score big points for a team, tend to cost a lot, so success in such a league depends on careful recruiting, lots of statistics, and a healthy amount of luck. It's the stat-crunching aspect of DFS that reinforced this pastime as a skill-based activity, a fact that was key to its classification as a legal form of sports betting in (most of) the United States.

DraftKings (<https://www.draftkings.com>), another DFS site, is guaranteeing more than \$1 billion in cash and prizes for 2015 as we went to press. This site offers a selection of GPP (Guaranteed Prize Pool) contests, which means that the site will pay out the entire prize pool even if a particular contest doesn't reach its entry limit. In a scenario where there are empty spots once the enrollment period closes, those who entered will get a share of the winnings for those unpaid slots. Other types of contests available from DraftKings includes head-to-head matches in which two players pit their picks against one another with winner-takes-all stakes. Leagues let you go up against one or

A New Take On eSports Betting

There's a third player in the eSports betting world, Unikrn (<https://unikrn.com>) and its take on the increasingly popular activity diverges from that of AlphaDraft and Vulcun. We spoke to Rahul Sood, a computing industry veteran, former *CPU* columnist, and co-founder and CEO of Unikrn, a Seattle-based eSports betting firm.

Q We know eSports is big business these days, but how big is it?

RS There are plenty of numbers out there, so there are different ways to measure the size of the opportunity. I like to think the size of an industry is dictated by the number of current and potential customers. In the case of eSports, the number of fans watching is about the same size as the National Hockey League. I am not the only one who thinks the number of fans of eSports will be similar to that of the NFL by 2017. It's truly a generational thing: If you have kids, and you wonder why they don't watch reruns of "Seinfeld" with you, maybe you should learn how to play League of Legends like I did!

Q What is Unikrn?

RS Unikrn is my new baby. Back when I was with Voodoo, I always knew the world of eSports would be massive and I was looking for an opportunity to get back in. There are over 205 million viewers of eSports in the last year. At Unikrn, our mission is to raise the level of engagement and excitement when it comes to participating in eSports. We started with Unikrn Arena, an online place for people to gather and bet on eSports safely and legally. There will be other products coming out down the road as well.

Q Question How is Unikrn different from the other eSports betting sites?

RS There's no one doing it the way we are. We offer a simple betting model. We build the odds, and people bet on the outcomes of matches and tournaments. Soon, they'll be able to bet on activity that happens in-game. There are other companies doing things on "fantasy eSports." the fundamental difference between fantasy and real betting is fantasy requires a deep level of knowledge of the space. So, if a fantasy eSports company is for the hardcore, Unikrn is for the mainstream. Unikrn also has global licensing for betting, and we are open for business in Australia, Ireland, and the United Kingdom with many more to come.

Q What is the biggest hurdle to success you see for Unikrn and similar services?

RS For us the biggest hurdle is dealing with the legal and liquidity side of the business. Fortunately, one of our largest investors is also one of the largest publicly traded wagering companies in the world. Tabcorp is actively involved with us, and we are their exclusive global partner for eSports. There are also debates on whether betting is good for sports or not. There is no question that betting can actually increase the competitive integrity of sports. Let it also be known that betting is legal and a part of the culture in most developed nations. In the U.S., you have to bet through a casino—go figure! I am certain things will change.

Q Does Unikrn offer services (aside from betting) for eSports fans in the U.S.?

RS Damn good question. You think I'd ever ignore the U.S.? Stay tuned, it's coming I promise!



more players at once. The 50/50 game types let every player that finishes in the top half of the field take home some winnings. The site also offers Freeroll contests, which don't cost anything to enter, but winnings come in the form of Entry Tickets or DraftKings Dollars, the site's cash-equivalent credits that you can use for entry into any real money contest on the site, but cannot be withdrawn or used on other DFS sites.

DraftKings and FanDuel account for more than 90% of the daily fantasy sports market, but there are other DFS sites, including Draft Team and DraftDay, and even NBC Sports recently announced plans to get in on the DFS phenomenon.

Fantasy eSports Sites

There are just a handful of websites handling fantasy eSports betting, and Vulcun (<https://vulcun.com>) and AlphaDraft (<https://alphadraft.com>) are the two most established. Because both of these sites follow a DFS model closely, there's a definite degree of skill involved in winning. You need to be able to accurately predict how players and teams will perform, and knowing performance numbers as well as regularly spectating matches is crucial.

AlphaDraft gives players a \$50,000 salary cap to craft their fantasy lineup, which consists of six individual professional gamers and one team. After making your selections, you earn fantasy points based on the match outcomes, and you compete against other people who have drafted gamers and teams. At the end of the specified time period, usually following a specific event, the player with the best-performing team walks away with real money. Events have varying entry fees, such as \$1, \$5, or \$10, but there are many contests that are free to enter. Just like in fantasy sports, AlphaDraft's professional gamers are ranked by their stats, though in this fantasy game, the stats are Kills/Deaths/Assists, MOBA positions (top, jungle, mid, ADC [attack damage carry], and support),

The screenshot shows the Unikrn website's 'Past Matches' section for DOTA 2. The header includes navigation links: GAMES, WATCH STREAM, ABOUT, SUPPORT, CAREERS, CONTACT, and a LOGIN / SIGN UP button. The matches are listed in a table-like format with columns for GAME, DETAILS, and STATUS. Each match entry includes the DOTA 2 logo, a team logo, the match date and time, the teams' names, their scores, and a 'RESULTS' button with social media links.

GAME	DETAILS	STATUS
DOTA 2	Jun 21 2015 9:30am Team Secret vs Evil Geniuses 1.50 vs 2.50	RESULTS
DOTA 2	Jun 21 2015 6:20am Invictus Gaming vs Team Secret 4.35 vs 1.20	RESULTS
DOTA 2	Jun 21 2015 3:30am Virtus.pro d2 vs Evil Geniuses 1.94 vs 1.82	RESULTS
DOTA 2	Jun 20 2015 1:45pm Team Secret vs Fnatic d2 1.22 vs 4.00	RESULTS
DOTA 2	Jun 20 2015 9:14am Invictus Gaming d2 vs Cloud9 d2 2.30 vs 2.30	RESULTS

Unikrn, a relative newcomer to the eSports betting arena, is designed to make betting less stat-intensive.

and salary. Of course, as the match occurs, AlphaDraft lets you watch the games live and see how you're doing with its real-time stat tracker.

Vulcun uses a similar salary cap structure as AlphaDraft, but here the cap is \$10,000. Team drafting differs depending on the game you're following, such as League of Legends, DOTA 2, CS:GO, or Hearthstone. For instance, when drafting a League of Legends team, the site tasks you with choosing five players, one for each position, as well as three flex players from any position. You can also designate one of your picks as the shotcaller, which boosts his or her point total by 25%, but you can't choose more than three players from one team.

Vulcun has taken the gamification a step further by creating its own currency. You can earn Vulcun's virtual gold by visiting the site daily and taking on "quests," which involve making player

performance and match outcome predictions. You can use gold to enter a selection of Vulcun's contests, and payouts also come in real money.

Fantastical Future

For those who're trying to wrap their heads around the explosive popularity of eSports, it's important to remember that it is truly a global phenomenon. It was only in 2013 that the U.S. government recognized eSports players as professional athletes. Yes, the physical demands of eSports differ from those of the most popular mainstream sports, but after watching a few events firsthand, it's hard to deny that pro gamers have a unique combination of physical and problem-solving capabilities that put them in rare company. With daily fantasy eSports, though, anybody can get in on the game, and possibly make some money doing it. ■



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Yeah, we know you have blogs to post, video to encode, reports to write, and code to compile. We do, too, but you have to take a break once in a while (and maybe blow some stuff up). That's why each month we give you the lowdown on what to expect from the latest interesting games.



The Witchering Hours

BY ANDREW LEIBMAN

\$59.99 (PC, XOne, PS4) • ESRB: (M)ature • CD Projekt RED
thewitcher.com

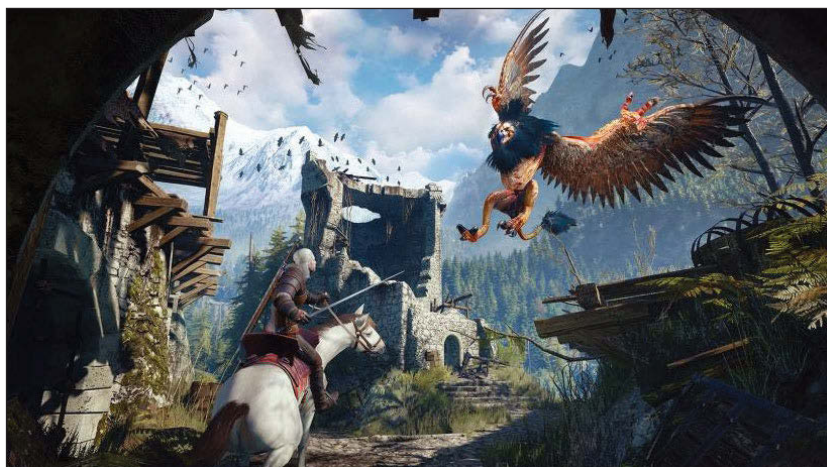
Plotted on a spectrum of RPG-ness, *The Witcher 3: Wild Hunt* resides on the far right and is exemplary of the genre. In its world, Witchers are an elite group of male-only humans that have undergone rigorous training and have survived the Trial of the Grasses, which is effectively a poisonous smoothie that kills 70% of those who partake and mutates the other 30% into superhuman monster hunters. Witchers are considered freaks by the bulk of society, but they're also the first ones people turn to when there's a mystery to solve, beast to slay, or specter to evict. *The Witcher 3* puts you in the laced leather boots of the series' longstanding protagonist, Geralt of Rivia.

This game is gorgeous, despite some the poorly optimized HairWorks effects (just turn it off), *The Witcher 3* is one of those rare games that is worth a graphics card upgrade. It's an open-world game that picks up where the second one left off, but you don't need to have played the previous games to keep up. Your primary goal is to find Ciri, the game's triple-threat plot device. She was trained as a Witcher (sans poison smoothie), as a Source she possesses natural magical abilities, and she's got royal blood, making her an appealing pawn for political and supernatural forces alike. Geralt has a deep fondness for Ciri and she looks up to him as a father figure. You also occasionally play as Ciri, who is a capable fighter in her own right. She also happens to be the latest obsession of the Wild Hunt, a spectral force that appears suddenly as a winter storm, not unlike the White Walkers on "Game of Thrones." Winter is coming for Ciri, and it's up to Geralt to rescue her.

This third-person action RPG features gear- and weapon-crafting systems, as well as a potion-brewing system that lets you weaken your enemies and increase your stats. *The Witcher 3* also has a deep talent tree that lets you increase Geralt's offensive and defensive magic,

combat acumen, alchemical aptitude, general skills, and more. You can upgrade weapons and gear with rune stones and enhance your talents with mutagens. There are occasional boss fights via witcher contracts and story beats, a handful of steamy romantic encounters, lots of lore to dig into, and numerous dialog options peppered throughout your encounters with NPCs that impact your journey through the game, sometimes dramatically.

Despite how well-executed everything else in this game is, the story of the *Witcher 3* is what will keep us plumbing its depths for a very long time. Even the most menial tasks, such as wiping out a ghoulish nest, have lasting consequences. Simple fetch quests have fun twists and unexpected results. There are more than 40 main quests, dozens of side quests, numerous hidden treasure sites and places of power; this game truly rewards patience and exploration. For instance, while searching for a baron's missing wife and daughter, a seemingly inconsequential note sitting on a bench turned our understanding of the situation on its head. This is high fantasy with a personal touch, and we are loving every second of it. ■



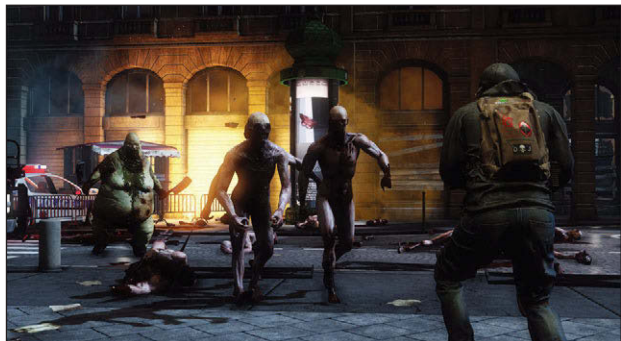


Tripwire Interactive's 2009 release *Killing Floor* was a squad-based shooter that dropped you and up to five friends into London following an outbreak of horrific zombie-like creatures from a biotech lab running experiments for the military. (Who would have guessed science could go so horribly awry?)

The follow-up, *Killing Floor 2*, is available now on Steam Early Access, and it takes the concept of the original game and turns everything about it up to 11.

For starters, this isn't a traditional shooter that makes you go strolling through a massive map full of corridors and rooms looking for stuff to shoot at. It's cut from the same cloth as *Gears of War's* Horde Mode, where the zombie hordes (or "Zeds," as they are called in this game) come looking for you. You have to survive wave after wave of horrific, mutated nasties who want nothing more in life than to chew on you, and the odds against you are stacked a little higher with each successive wave. New monster types and the overall enemy count increase gradually, until you finally face off against a level's boss, but no matter where you go, the fight comes to you.

That's not to say that you can just stand with your back in a corner and gun them all down; such a strategy will kill you faster than just about anything else you can do. You (and/or your squad of up to six players) have to strike just the right balance between staying on the move and using the environment to your advantage. Some areas in a level will provide no cover, but others include bulkhead doors that you can weld shut and so on, giving you a moment to regroup and reload. Between each wave, you have a limited amount of time to get to your level's gun



Time To Kill Some Zeds

BY CHRIS TRUMBLE

\$29.99 (PC) • ESRB: (R)ating Pending • Tripwire Interactive
www.tripwireinteractive.com

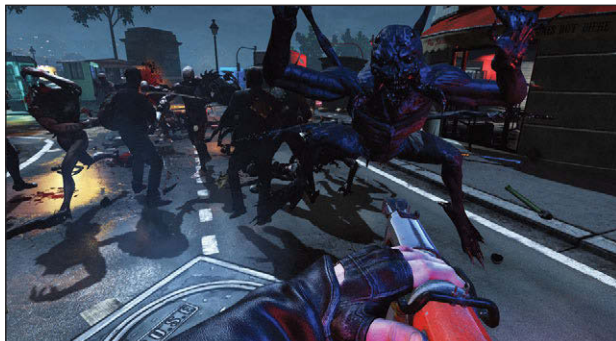
vending machine to trade the cash you rack up from putting down Zeds for better weapons and more ammo.

You also gain experience along the way and can use those points to improve your character's damage with certain weapon types or to improve support and healing skills, etc. This element of the game adds a surprising amount of depth to what is essentially a run-and-gun meat grinder. There is a story—*Killing Floor 2* takes place a short time after the events of the first game, and the Zed infestation has spread from London to continental Europe—but the real star of this show is fast-twitch action and buckets of gore.

Killing Floor 2 puts a dizzying array of weapons at your disposal, including guns, a plethora of melee weapons, explosives, and more, and you must use them to blast, slash, and blow your way through the Zeds until your squad is all that's left standing.

The game runs on the Unreal Engine 3, which is a little long in the tooth at this point, but Tripwire uses some clever tricks to keep things moving quickly and looking good. For instance, instead of rendering a blood splatter as a new, separate object on top of a floor or wall, they actually update the floor or wall's texture map in real time so that the blood effect becomes part of it. Not only is this easier on system resources, but it also means that when you kill a Zed in KF2, its blood becomes a permanent fixture in the level until the end of the match.

Although its premise is simple, there's no denying this game's appeal. If you and a handful of friends are looking for a little zombie-eviscerating catharsis, *Killing Floor 2* delivers. And delivers. And delivers . . . ■





Heroes of the Storm is at once both a departure and a homecoming. Although you could say that MOBA games, notably Dota 2 and League of Legends, owe their success to Blizzard properties Starcraft and especially Warcraft III, HotS is the company's first official venture into the genre. Here we are, halfway through 2015, and Blizzard is finally realizing its destiny over a decade after the original DotA took the community by, ahem, storm.

Don't forget that HotS is also a departure. In fact, Blizzard doesn't even want the game to be lumped in with other MOBA games—it's a "hero brawler," thank you very much. Call it whatever you want; the taxonomy is largely irrelevant. Comparisons to LoL and Dota 2 are inevitable, and millions of players (and dollars) are at stake. Perhaps more than any other game in Blizzard's lineup, HotS needs to stick the landing.

Of course, in order to jump-start the game, Blizzard is relying on the rest of its (extremely popular) catalog. Unlike Overwatch, an upcoming Blizzard project that also lets you do battle as hero characters, the combatants in HotS are familiar faces drawn primarily from Blizzard's Warcraft, StarCraft, and Diablo universes. If the game accomplishes nothing else, the satisfaction of being able to steer Blizzard's classic heroes through this brand-new demolition derby is nearly impossible to articulate. Trust us, once you bury Thrall's Doomhammer in Tassadar's face, you'll understand what we're talking about.

That's the way it works in theory. In reality, though, the heroes themselves are part of HotS' freemium model. In order to play as a specific hero whenever you want, you have to unlock him or her either by grinding in-game gold or paying cold, hard cash. Blizzard does offer a small portion (five at first, and two more are added as you gain XP) of its roster as F2P, rotating them on a weekly basis. In order to play the game's Hero League, though, you have to unlock 10 heroes, which means hardcore players will almost certainly reach into their wallets to rise to the top of the ranks. You can also pay for cosmetic skins for each of the heroes.

PvP With Blizzard's VIPs

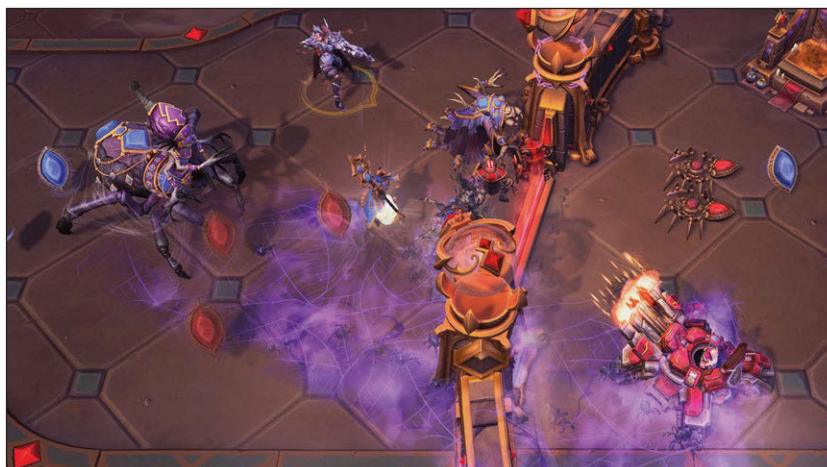
BY VINCE COGLEY

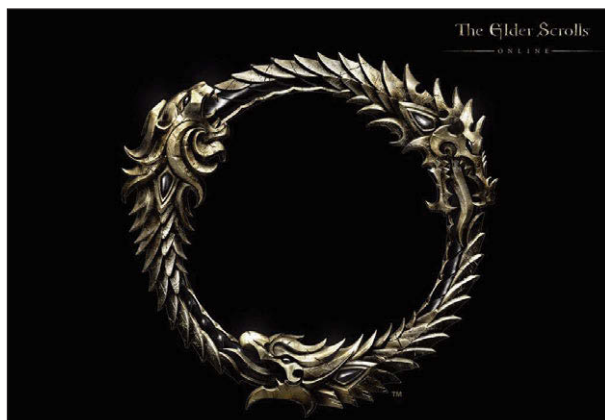
Free (PC, Mac) • ESRB: (T)een • Blizzard Entertainment
us.battle.net/heroes

Let's get down to the game itself. Rightly or wrongly, Blizzard has developed a lot of its content to be snack-sized. If you're on your lunch break or have an hour between classes, you can run a heroic dungeon in World of Warcraft, for example. This is one of HotS' guiding principles. Games are usually over and done in less than 30 minutes. HotS also doesn't busy itself with many of the fixtures of other MOBAs, such as in-match items to buy and equip, jungling, last hitting, and so forth.

All that said, even if you reinvent the wheel, the end result is still a wheel. Much of the gameplay still centers on demolishing your opponents' towers and other physical structures as you work your way toward tearing down their core, which is the ultimate goal. However, each of HotS' maps have secondary objectives that confer a significant, if not overpowered, advantage when completed. Whether the objective is gathering a special resource or controlling a key map location, pursuing them usually puts you on a collision course with your opponents, resulting in frequent team fights.

Relatively small map size and the ability to ride a mount further encourage team fights. The frenetic pace could be a turnoff for Dota 2 and LoL players who prefer longer, more meticulous matches. If you're fixing for a good scrum, Heroes of the Storm delivers it early and often. And that's not a bad thing. ■





We missed The Elder Scrolls Online when it launched back in April of last year. Since then the game has gotten some significant updates and dropped the mandatory subscription fee in favor of a flat \$59.99. An optional monthly \$14.99 subscription plan, called “ESO Plus,” grants you additional in-game currency and faster leveling. One more disclosure: We’re huge fans of the previous Elder Scrolls games, including Morrowind, Oblivion, and Skyrim. But within the first 10 minutes, we realized that Elder Scrolls Online: Tamriel Unlimited isn’t “Skyrim with friends.”

In transforming the series into an MMO, developers at ZeniMax Online Studios have sacrificed the level of immersion you experience in a game like Skyrim. By default, nearby players are audible. Early on, we were privy to a one-sided argument from a Nord named BamaFan4Life29. A simple setting disables proximity voice, but there’s nothing stopping fellow players from jumping incessantly and pointlessly attacking our character. Furthermore, it’s hard to feel like the last hope for the realm when dozens more are performing the same actions as you wherever you go.

Harder to get past was the lack of interactivity in the environment. In Oblivion, we made a habit of collecting skulls and were knee-deep in them by the end of the game. This freedom to pick up anything has become a hallmark of the franchise. In ESO:TU, however, a shelf stacked with a dozen or more books may or may not have a readable book on it, and when it does, it’s one book that you can’t take with you. The same goes for food and dishes



A Solid MMO (Just Don’t Expect Multiplayer Skyrim)

BY ANDREW LEIBMAN

\$59.99 (PC, XOne, PS4) • ESRB: (M)ature • Bethesda Softworks
www.elderscrollsonline.com

on tables, racks of armor and weapons, and more. The world of ESO:TU says “Look, but don’t touch.”

Despite this game’s impressive lineage, we learned quickly to judge it on its own merits, as an MMO. After hooking up with a few pals, the game blossomed. An example of what this game gets right occurred when we came upon a Dark Anchor, one of dozens of portals through which Molag Bal sends his minions and exerts his will upon Tamriel. Too weak to take the enemies head-on, we used ranged attacks as higher-level players did the real damage. Upon death, we quickly rejoined the battle suffering only a little wear and tear on our armor and weapons. No reviving, no possibility of a team wipe and forced restart, and the varied combat options helped us contribute without feeling like a burden.

When it comes to visual detail, ESO:TU looks good as long as you don’t look too closely. The landscapes and countryside are lush and colorful, the towns and cities are alternately rustic and full of grand architecture. Compared to other MMOs, it is an attractive game. Compared to games like Skyrim with mods or The Witcher 3: Wild Hunt, ESO:TU looks like a five year old game, though the PC version looks markedly better than the Xbox One version we played.

If you’re looking for an MMO with an Elder Scrolls setting, this game is for you. On the other hand, if you’re looking for a follow-up to Skyrim with some MMO trappings, you may be less impressed. ■



Q&A With Cooler Master's Rajiv Kothari

Regional Marketing Manager, North America, Talks MasterCase 5

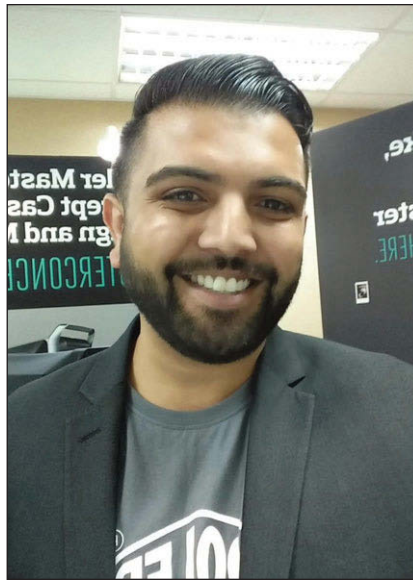
Q: What does Cooler Master's new slogan "Make It Yours" mean?

RK: Our new slogan highlights one of the main reasons why people build their own PCs. It's a sense of pride—a creation that you make, and Cooler Master has always championed that do-it-yourself mentality over the last 20 years. We saw that the enthusiasts using our products created and shared their passions through PC building, so we've aligned with this maker spirit and create products and an ecosystem that will help inspire that enjoyment and freedom to truly make a unique build.

Q: Tell us about the MasterConcept. When did the project start, how long did it take, who was involved, and what was its purpose?

RK: The MasterConcept is the brainchild of our product design team, which collectively has more than 20 years of case design experience. The idea was to create a blueprint for our future, a product that we could design with everything a maker could desire from a PC case, and then to better understand how to bring it to the masses.

The project took about six months, and we worked with some of the world's top modders and power users to get a broad, representative view on what the community wants. The result was the best PC case ever, because it comes out of the box looking like something that you might have modified yourself, inside and out. It



became all about what we wanted to do with the PC.

Q: Was it difficult for five people from different backgrounds to find common ground? How did the collaboration process work?

RK: It was interesting, because we brought these five people to our Taiwan headquarters and had them do a one-week workshop with our internal team to truly understand the ins and outs of case development. Their many years of case modding and tinkering helped us really take into account all the minor details that would be appreciated by novice users and experts alike. The collaboration was extremely positive and is one of the key reasons we intend to do this again as we develop new, innovative technologies.

Q: So, the end result of the MasterConcept was the MasterCase, right? What can you tell us about the MasterCase?

RK: The MasterCase will come in three preconfigured levels to meet your needs: The MasterCase 5, the MasterCase Pro 5, and the MasterCase Maker 5. We're also making a series of accessories available through our CM store, and if you start with a MasterCase 5 and then decide you'd like a MasterCase Maker 5 you can get the parts you need to do the upgrade yourself. This provides a very flexible system that lets users who may not need the top-of-the-line version right out the gate expand their case as their needs change over time.

Q: What is the "FreeForm" concept, and how does it impact the MasterCase and builders using the MasterCase?

RK: FreeForm is what allows this upgrade path through the whole MasterCase family. It was designed to advocate a new relationship that binds component makers and PC builders closer together by providing you with unparalleled flexibility to reconfigure the interior specs or the exterior looks of the MasterCase so you can truly "Make It Yours."

Q: What does "exterior expandability" mean? We've seen a few cases with modular interiors, but modular exteriors are less common.



RK: FreeForm aims to provide builders full flexibility and controls over how the case looks and functions. Even as your needs and tastes change over time, you will be able to customize and tailor your build with the added accessories and add-ons.

Q: When will the MasterCase be available at retail?

RK: The MasterCase 5 will be available late July, while the MasterCase Pro 5 will be available in mid-August. The MasterCase 5 Maker will be announced at a later time. Of course, you can always upgrade to your liking when the accessories are available.

Q: Your site suggests that the MasterCase is the first member of a new family of products. Can you talk about some of the other items that will be part of the family and when we will get to see them?

RK: We have a lot of new products that champion the maker spirit and we hope to share more news as we approach CES 2016. You can bet that modularity will play a big part in every product, so that your needs are always met.

Q: Is there anything else you'd like readers to know about the MasterCase or Cooler Master's MasterConcept?

RK: We designed the MasterCase to change the way PCs are designed, made, bought, and used, so we really look forward to seeing what the makers of the world will create with it. As far as customization, the accessories list can continue to grow, and we will definitely reach out to the community on what they are looking for so we can help them make it. So stay tuned for more at www.coolermaster.com! ■

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Orange Park, FL

www.wardogz.org

06.27.15

The Promised LAN
Prattville, AL

www.thepromisedlan.weebly.com

06.27.15

For LAN Sakes Let's Play
Towanda, PA

www.forsakenempire.com

07.04-05.15

LANified! 21: Summoner's Stand
Calgary, AB

www.lanified.com

07.09-12.15

MillionManLan 14
Louisville, KY

www.lanwar.com

07.10-12.15

LANFest MLP'015 Summer*
Hamburg, NY

lanfest.intel.com

07.14-19.15

Mage Makers Gamecon 2015
Austin, TX

www.magemakers.com

07.16-19.15

LAN in the Highlands
Seven Springs, PA

www.clubconflict.com/events/LAN2015

07.17-20.15

PDXLAN 26*
Portland, OR

pdxlan.net

07.17-19.15

Ancient City Con 9
Jacksonville, FL

www.ancientcitycon.com

07.17.15

WUCC KNFE LAN 9
Whitewater, WI

www.knfe gaming.us

07.23-26.15

QuakeCon 2015
Dallas, TX

www.quakecon.org

07.25-26.15

Naois Gaming
York, PA

www.naoisgaming.com

07.25-26.15

LAN-A-THON Under The Sun
San Diego, CA

sandiegolan.net/lanathon.html

07.25.15

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lanfest.intel.com

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Wichita LAN 29

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www.wichitalan.com

08.21-23.15

LANFest Sacramento Summer 2015*

Folsom, CA

lanfest.intel.com

08.28-31.15

PAX Prime*

Seattle, WA

www.paxsite.com

08.28-30.15

MidWestLAN15

Pewaukee, WI

www.midwestlan.com

08.29.15

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09.04-06.15

Wardogz LAN Party

Orange Park, FL

www.wardogz.org

09.26.15

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10.03-04.15

NeXus LAN 16

Miamisburg, OH

www.nexuslan.org

10.17-18.15

FortLAN 7

Fort Wayne, IN

www.fortlan.org

10.24.15

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10.30-11.01.15

ASUS Presents Baselan 29

Winnipeg, MB

www.aybonline.com

10.31-11.01.15

Naois Gaming

York, PA

www.naoisgaming.com

11.06-08.15

PDXLAN Charity Event

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pdxlan.net

11.28.15

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If you love great mods, *CPU* is the place for even more coverage of the latest mods, the greatest modders, and mod contest winners from all over. In these pages, you'll find modified stock cases, custom builds, and everything in between.



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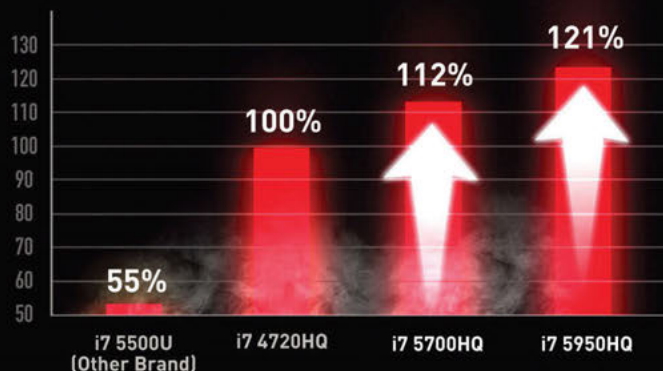
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Q&A With DXRacer Marketing Director John Spiher

Don't Lean In, Lean Back

Q : Your site says DXRacer started out making racing seats for cars in 2003. Can you tell us about that, and how you decided to start making gaming chairs?

JS : Absolutely! Initially, Tim (our CEO) was heavily involved in the automotive industry. Our factory produced racing seats, car seats, and other third-party furnishing solutions for automobiles. As we've always had a passion for racing, we focused primarily on seats for race cars. What we found, however, was that not everyone has a top-tier race car, so we opted to take the same comfort, security, and ergonomics of a racing seat and make them applicable to the masses by adapting them into office furniture. Content creators and competitive players need to be seated, comfortable, and at the top of their game for long periods of time. We provide a tool that enables that.

Q : How did you begin making special-edition chairs for pro gaming teams, and how do you pick which teams to make chairs for?

JS : Branding is everything. In most standard sports, you have quite a variety of branded merchandise. Esports is no different in that players, teams, events, and organizations want to create a community around their brand, and one of the coolest ways to show your support is by wearing a shirt or repping something with their logo. While our brand is important to us, one of the benefits of owning our factory is that we have the ability to create customized products for our partners, which in turn gives their fans additional ways to support their favorite teams.

Our vetting process for sponsorship is extensive. We've lined up some of the top gaming organizations all over the world, and we aim to only partner with the best. We receive a multitude of applications daily, and are always searching for brands that line up with our values and ideals. Just as a potential



customer researches our various chair models, we like a good fit.

Q : We noticed that you have a couple lines of chairs for console gamers. How do they differ from PC gaming chairs?

JS : Our console chairs are quite a bit different, actually. Currently, our console chairs are more like lounge chairs. They don't have adjustable height, and are meant for sitting in front of a TV or other entertainment. They tilt on an axis rather than via a control mechanism. We also offer a variety of console chairs that come with an ottoman, which can either be utilized as either a footrest or an additional seat.

Q : What sets a DXRacer chair apart from chairs from your competitors?

JS : Most importantly, the owner of DXRacer USA also owns the factory. We don't lease it. We don't just produce our products somewhere random to save on costs. We own it. We ship directly to our distribution offices all over the world. I'm confident we're the only company that can say that.

Q : Have you ever made special-edition chairs for specific game titles, and if so, which ones?

JS : We actually created a custom chair for Infinite Crisis, a MOBA produced by Warner Brothers Studios. We may be releasing a new licensed title for an upcoming game release, but details aren't finalized on that yet. What I can say, however, is we relish the opportunity to work with game developers and studios. They should contact us—we love those projects.

Q : If you had to pick one feature of a DXRacer chair that you think is the best, what would you say it is?

JS : Our recline is what we're known for. Being able to lean back to a full 170 degrees and not topple over is a feature that is unique to DXRacer. One of our favorite interactions at trade shows is letting people experience that for the first time. They get the feeling they're about to fall over—but they don't. It creates a much lighter mood for our customers, and it's quite fun. Many of our users can attest to the quality of our recline, and have fallen victim to taking a nap in our chairs. Who needs a bed anyway, right?

Q : What else should CPU readers know about DXRacer?

JS : We're real people who work hard to create a tool that enables users to sit and do what they love for longer periods of time. To us, it doesn't matter if that's gaming, coding, working, or whatever else. We just want you to be properly postured, comfortable, have your body supported ergonomically, and look cool. We love gaming and eSports, and can't wait to see what the future holds. Our most important goals are coined pretty well by our tag line: Sit Better. Work Harder. Game Longer. ■

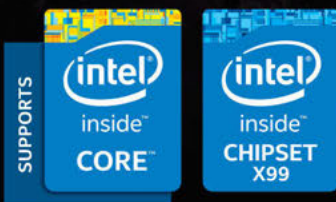
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